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ANTHROPOMETRIC SURVEY
OF THE ROYAL THAI ARMED FORCES

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ROBERT M. WHITE
Anthropologist

2084

Sponsored by

ADVANCED RESEARCH PROJECTS AGENCY
Washington, D. C.

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Natick, Massachusetts

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SYNOPSIS

An anthropometric survey of military personnel of the Armed Forces of Thailand was conducted between October 1962 and March 1963. The survey was sponsored by the Advanced Research Projects Agency, Washington, D. C. and was authorized by ARPA Memorandum of July 27, 1962, Subject: Anthropometry Research in Southeast Asia.

Body measurements were obtained on a total series of 2,950 men, consisting of 2,010 of the Royal Thai Army, 610 of the Royal Thai Marine Corps and 330 of the Royal Thai Air Force. Fifty-two measurements were made on each individual. The anthropometric data have been analyzed and are presented in this report in the form of statistical values.

It was found that the average height and weight of Thai military personnel were equivalent to the 5th percentile values of height and weight for United States soldiers. The Thai soldier is about four inches shorter in stature and 30 pounds lighter in weight than the average United States soldier.

The results of the survey, which provide information on the body size of Thai military personnel, may be utilized in the engineering design and sizing of clothing and equipment intended for use by the Royal Thai Armed Forces.

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1. INTRODUCTION

a. Purpose

Anthropometric data constitute a basic requisite for defining the elements of body size in the human engineering of man-equipment systems. Effective human engineering requires the use of data on the specific population for which the equipment is intended. Since no adequate data existed on the Royal Thai Armed Forces, an anthropometric survey was conducted to collect data on the body dimensions of a large sample of this military population. Analysis of these data has made it possible to define the range and variation in body size to be expected in the military personnel of Thailand.

The results of this survey should be utilized in all areas of research and development where detailed knowledge of Thai body sizes and proportions are necessary. Anthropometric data on Thai military personnel are of primary application in the engineering design of military equipment for the Royal Thai Armed Forces. The further application of this information to problems of design, sizing and fit of military clothing and personal equipment will result in increased efficiency, performance and comfort. Data on the range and variation of body size in the user population thus may be employed in the improvement of size systems and tariffing in order to achieve increased logistic efficiency and economy of supply.

b. Summary

An anthropometric survey of military personnel of Thailand was carried out between October 1962 and March 1963. A total series of 2,950 was measured, including 2,010 men of the Royal Thai Army, 610 men of the Royal Thai Marine Corps and 330 men of the Royal Thai Air Force. Fifty-two body measurements were made on each individual. The results of the survey, together with analyses of the data, are presented in this report.

The survey was sponsored by the Advanced Research Projects Agency (ARPA) of the United States Department of Defense. The data collection in Thailand was carried out under the authority of the Ministry of Defense of Thailand. The project was supported by the Military Research and Development Center (MRDC), a joint United States-Thailand research and development activity in Bangkok. The survey was directed by Mr. Robert M. White, Head, Anthropology Laboratory, United States Army Natick Laboratories, Natick, Massachusetts. During his tour of duty in Thailand, Mr. White was attached to the ARPA Research and Development Field Unit, the United States element of the Military Research and Development Center in Bangkok.

c. Acknowledgements

While the survey was planned and supervised by an American anthropologist, the collection of anthropometric data was performed entirely by Thai personnel. Many individuals, therefore, contributed to the success of the anthropometric survey in Thailand. All of the personnel, both Thai and American, of the Military Research and Development Center in Bangkok were extremely friendly and helpful in their support of this project.

The support of Major General Singchai Menasuta RTA, Director of the Military Research and Development Center and members of his staff throughout the survey is gratefully acknowledged. Special thanks is extended to Colonel Lua Karnchanapimai RTA, Deputy Director MRDC, for his constant and skillful supervision of the many details, large and small, involved in the planning and execution of the survey. Colonel Sawang Thestam RTA and Colonel Prasert Wongsuwan RTA both served as project officers during the survey and were extremely helpful in this capacity. The efforts of Colonel Prasert in directing the measuring sessions of Army personnel at Chiangmai, Haad Yai and Ubol were greatly appreciated. Group Captain Arun Disabaed RTAF assisted as liaison officer during the measuring of Royal Thai Air Force personnel at Don Muang. Commander Sommart Hansavina RTMC was especially helpful as liaison officer with the Royal Thai Marine Corps during the processing of personnel at Sattahip.

The interest and support of the American personnel of the ARPA Research and Development Field Unit in Bangkok were sincerely appreciated. Mr. Thomas W. Brundage, Director, and his deputy, Colonel Willis B. Sawyer USAF, were both extremely helpful and understanding during all phases of the survey. Thanks are also expressed to Lieutenant Colonel John D. Hale USA, Commander L. O. Nassett USN, Lieutenant Colonel William R. Quinn USMC, Major G. J. Akerland USAF and Dr. Lee Huff for their interest in the project. Mr. William R. Taylor, Administrative Officer, provided invaluable aid in solving many transportation and supply problems.

The anthropometric survey in Thailand could not have been possible without the understanding and cooperation of the many military commanders and their staffs who made available facilities at their installations and personnel under their command. The assistance of the following officers is gratefully acknowledged: Major General Prayul Nunpakdi, Commanding General, First Infantry Division, RTA; Colonel Yos Dhephusadin, Chief of Staff, First Infantry Division, RTA; Major Sanit Raychareon, Assistant G-1, First Infantry Division, RTA; Rear Admiral Prince Galavarnadis Disgul, Commandant, Royal Thai Marine Corps and Base Commander, Sattahip; Captain Sophone Suyarnsetragarn, Deputy

Commandant, Royal Thai Marine Corps; Group Captain Amphorn Korndee, Commanding Officer, First Wing, RTAF. The assistance of the commanding officers of the 5th, 6th and 7th Regimental Combat Teams at Haad Yai, Ubol and Chiangmai in making available Army personnel of their units also is acknowledged.

Colonel Pramote Thuvanuti of the Quartermaster Corps, RTA enthusiastically supported the survey and provided personnel for two of the measuring teams. Major Aree Viriya represented the Medical Corps, RTA and arranged for the Medical Corps measuring team. Lieutenant Suchit Boonag, S-3 of the Marine Corps Education Center was particularly helpful with arrangements for processing Marine Corps personnel at Sattahip.

Grateful acknowledgement is made of the outstanding performance of the personnel listed below who worked on the measuring teams. These individuals put in many hours of exacting and tedious measuring in order to collect the anthropometric data of the survey.

First Infantry Division, Royal Thai Army

Cha Sip Ek	(Sergeant 1st Class)	Prachak Suwanpat
Cha Sip Tri	(Sergeant)	Sawat Raitim
Sip Ek	(Corporal)	Manit Manothai
Sip Ek	(Corporal)	Tot Somboenchit
Sip Ek	(Corporal)	Chalermchai Boonma
Sip Ek	(Corporal)	Tongsuk Kongsri
Sip Ek	(Corporal)	Prasert Klaewkla
Sip Tho	(Private 1st Class)	Sermak Wongpan
Sip Tho	(Private 1st Class)	Chamnearn Nuamsuwan
Sip Tho	(Private 1st Class)	Charin Rangabpit
Sip Tho	(Private 1st Class)	Samart Netboon
Sip Tho	(Private 1st Class)	Watana Mesomboon
Sip Tho	(Private 1st Class)	Boonchoo Suwanakom
Sip Tho	(Private 1st Class)	Surin Singhapak
Sip Tho	(Private 1st Class)	Dilok Tonglamul

Medical Corps, Royal Thai Army

Sip Ek	(Corporal)	Masuwan Yamyin
Sip Ek	(Corporal)	Miyom Foofuang
Sip Ek	(Corporal)	Kampa Chanbairak
Sip Ek	(Corporal)	Amoey Tongnoi
Sip Ek	(Corporal)	Prempramoje Vitesanaponse

Quartermaster Corps, Royal Thai Army

Mr. Soonthon Panyawai	Mr. Prayoon Ouchareon
Mr. Kularp Kamearm	Mr. Cherd Nautchan
Mr. Serm Mayom	Mr. Poj Rangart
Mr. Haw Romruen	Mr. Dam Kitsanga
Mr. Sawasdi Chaikwang	Mr. Chan Praeroongsap

Royal Thai Marine Corps

Cha Tho	(Lance Corporal)	Sornchai Rojanamon
Cha Tho	(Lance Corporal)	Amnuoy Sakulparahom
Cha Tho	(Lance Corporal)	Pricha Chairassamee
Cha Tho	(Lance Corporal)	Rangsi Silakorn
Cha Tho	(Lance Corporal)	Yut Butrat
Cha Tho	(Lance Corporal)	Prachoom Pinveha
Cha Tho	(Lance Corporal)	Kla Tongveha
Cha Tho	(Lance Corporal)	Kitja Sathientip
Cha Tho	(Lance Corporal)	Charn Watanawong
Cha Tho	(Lance Corporal)	Mongkol Nimsiri
Cha Tho	(Lance Corporal)	Tongchai Chanarun
Cha Tho	(Lance Corporal)	Pratuerng Faktongkam

Royal Thai Air Force

Rua Arkas Tho	(1st Lieutenant)	Pradit Adeedto
Rua Arkas Tho	(1st Lieutenant)	Sopon Chitprapai
Rua Arkas Tho	(1st Lieutenant)	Yan Pinpan
Phan Cha Arkas Tho	(Technical Sergeant)	Wimol Hongyim
Phan Cha Arkas Tho	(Technical Sergeant)	Chaiwat Dangprasert
Cha Arkas Ek	(Airman 1st Class)	Pairaj Chimchumsil
Cha Arkas Ek	(Airman 1st Class)	Jira Jaruchinda
Cha Arkas Ek	(Airman 1st Class)	Thaweesak Naraweo
Cha Arkas Ek	(Airman 1st Class)	Wichit Yeamrungruang
Cha Arkas Ek	(Airman 1st Class)	Phol Suksawang
Cha Arkas Ek	(Airman 1st Class)	Choosak Pongsomboon
Cha Arkas Ek	(Airman 1st Class)	Samarn Anchurit
Cha Arkas Ek	(Airman 1st Class)	Prayoon Prachantasain
Cha Arkas Tho	(Airman 2nd Class)	Narong Chareonruay
Cha Arkas Tho	(Airman 2nd Class)	Wirawat Waitruatrok

The valuable assistance of personnel of the Computer Branch, U. S. Army Natick Laboratories, who accomplished the data processing and statistical computations is gratefully acknowledged. Mr. Richard L. Burse and Private First Class Thomas D. Murray, of the Anthropology Laboratory, were extremely helpful in checking the data and in the preparation of material for the final report; their efforts are sincerely appreciated.

2. PROCEDURES

a. Planning and Organization

Planning for the anthropometric survey of Thailand was carried out at the Military Research and Development Center, Bangkok in September 1962. The first consideration to be taken up was the size of the sample of men to be measured. It was estimated that a series of between 3,000 and 3,500 men would serve as an adequate sampling of the Armed Forces of Thailand. In order to provide representation from all services in the Armed Forces, it was planned that a large sample would be drawn from the Royal Thai Army, with smaller samples from the Royal Thai Navy and Royal Thai Air Force. Subsequently, a decision was made that Royal Thai Marine Corps personnel would be measured as representatives of the Navy.

During the planning for the survey, it was stipulated that men of all age groups would be included in order to cover the range of military personnel from young recruits to older veterans. It was also planned that enlisted men of all ranks would be measured. Although the plan for the survey did not include the measurement of officers, it was requested that a small sample of Air Force flying officers be obtained in order to provide information for application to flight clothing and equipment. With respect to the geographical location of military installations, it was planned that a large sample of Army personnel would be measured in the Bangkok area, while the Air Force and Marine Corps samples would be measured at an Air Force base and at a Naval base near Bangkok. Subsequently, further samples of Army personnel were obtained at three installations in the east, north and south of Thailand.

A significant aspect in planning the anthropometric survey of Thailand was the provision that all of the measuring would be carried out by Thai personnel who would be trained and supervised by a qualified physical anthropologist. This procedure proved to be entirely satisfactory, not only since trained and experienced American personnel were not available, but also because the utilization of Thai personnel had the advantage of operational convenience. The fact that the first large-scale anthropometric survey of military personnel in Southeast Asia was carried out by the Thais themselves is a source of considerable satisfaction.

b. Measurements and Equipment

The initial step in setting up the measurement procedure was the selection of the body dimensions to be measured. A list of approximately fifty measurements was drawn up for consideration. These were reviewed with Thai military personnel, and several additions were

made at the request of Thai Quartermaster officers. The fifty-two body measurements finally agreed upon included dimensions of all parts of the body: weight, body lengths, breadths and circumferences, together with selected measurements of the head and face, the hands and the feet. The measurements chosen fell into two general categories. Some of the measurements are those of primary use in the design, sizing and grading of clothing, while others are of importance in the design and sizing of military equipment from the standpoint of human engineering. The measurements are described in Section 4,a.

Following the choice of measurements to be taken, a data sheet was prepared for use in recording the measurements and the background data on each man. Although the data sheet was drawn up in English, a complete Thai translation was provided. The data sheet was arranged so that the recorded information subsequently could be transferred to punched cards for use in data processing. The data sheet is reproduced in Appendix A.

Standard anthropometric instruments were used throughout the survey. Anthropometers (calibrated metal measuring rods, 2 meters long) were used to measure stature and various body lengths; the anthropometers also were utilized as large sliding calipers for body breadths and for measurements of some arm and leg segments. Small sliding and spreading calipers were used for measurements of the head, face and hands. Body circumferences and surface measurements were taken with 2-meter steel tapes. Foot length, instep length and foot breadth were measured on a special foot board, while heel breadth was taken with sliding calipers. Weight was taken on spring platform scales, calibrated in kilograms. All of the body dimensions were measured and recorded in the metric system, with the measurements taken to the nearest millimeter.

c. Measuring Teams

A total of twelve measuring teams of five men each were utilized during the anthropometric survey in Thailand. The first three teams consisted of fifteen men of the First Infantry Division, RTA; these teams measured a large part of the Army sample in Bangkok. Two additional Army teams were made up of ten civilian clothing technicians from the Quartermaster Corps, RTA. Another Army team consisted of five men supplied by the Medical Corps, RTA. Three teams of fifteen Marines were trained and utilized for measuring Marine Corps personnel, and three teams of fifteen Air Force men were trained and used to measure Air Force personnel.

Each measurer was provided with a recorder who wrote down the measurements called out by the measurer. The recorders were furnished by the installation where the measuring was carried out.

The basic measuring team consisted of five men: a team leader and four measurers. The team leader was responsible for filling in the background information on the data sheet and for recording weight; it was also his assigned duty to maintain an even flow of men through the measuring line. Each of the four measurers was responsible for taking a block of related measurements.

In order to increase the number of men measured during a working day, three measuring teams were used simultaneously at most installations. It was thus possible to operate three processing lines and effectively triple the number of men measured per day. On the average, about 120 men were measured per working day.

In order to simplify training and to increase operational efficiency, all measurements to be made with one instrument were grouped together on the data sheet. In this way any one measurer learned the use of only one type of instrument and was responsible for a block of related measurements. The fifty-two measurements, therefore, were divided into four groups or blocks, so that an individual would be measured by four measurers in turn as he progressed through the processing line. The instructions used in training the measurers are given in Appendix B; these instructions show the order of the measurements in accordance with the data sheet.

The training of the measurers was carried out by the anthropologist in charge of the survey. Four training sessions were utilized, and three measuring teams or 15 men were trained at each session. Initially, the measurers were briefed on the survey and their duties were explained. The anthropometric instruments were then demonstrated and their use described. Sketches illustrating the measurements and sample data sheets were distributed to the measurers so that they could become familiar with the measurements and the sequence in which they were to be taken. The measurers then practiced with the instruments by measuring each other. After becoming familiar with the use of the instruments, the measurers were drilled by repeatedly measuring the instructor and several test subjects in order to achieve consistency and reliability.

The measurement of personnel during the survey at Bangkok, Don Muang and Sattahip was carried out under the supervision of the anthropologist in charge, while the subsequent measuring sessions at Chiangmai, Haad Yai and Ubol were supervised by Colonel Prasert, RTA. Techniques of measurement were frequently checked for accuracy and consistency.

d. Data Processing

Processing of the data from the anthropometric survey of Thailand was accomplished by the Computer Branch, U. S. Army Natick Laboratories, Natick, Massachusetts. After coding the background information, all of the data were transferred from the data sheets to punched cards. Three cards were required for the data on each man in the series.

The background data and the measurement data were checked by examination of print-outs from the punched cards in order to eliminate duplications and obvious errors. The data for each of the 52 measurements were checked by careful examinations of the ranges and frequency distributions.

Computations of statistical values for the anthropometric data were then carried out on a General Electric 225 digital computer. These computations were based upon the use of ungrouped whole centimeter values for the larger body measurements. In the case of the smaller measurements of the head, hands and feet, the data were grouped into five millimeter (.5 centimeter) intervals.

Most of the statistical values are reported as computed. In the case of the percentiles, however, a further check on the computed values was made by plotting percentile curves. In this method, the cumulative percentages from the frequency distribution of each measurement are plotted on probability scale graph paper and the points are connected by a smooth line or curve. The percentile values given in this report are those read from these smoothed curves. The percentile values shown in inches were obtained by multiplying the metric values by .3937.

3. DESCRIPTION OF THE SAMPLE

a. Introduction

Although the main purpose of the survey was to obtain data on the body sizes of Thai military personnel, various other kinds of background information were recorded so that the samples of men who were measured could be described and characterized. The background data which were recorded for each man included the following: name and serial number, location and date of measuring, birthplace and home, religion, age, military service, branch, unit, rank, military specialty or duty and length of service.

b. Chronology of the Survey

The process of measuring military personnel in Thailand was initiated in October 1962 and was concluded in March 1963. The progress of the survey is outlined in Table 3.1.

Table 3.1. Chronology

<u>Dates</u>	<u>Location</u>	<u>Service</u>	<u>No. of Men</u>
17-22 Oct 1962	Bangkok	Royal Thai Army	791
13-14 Nov 1962	Don Muang	Royal Thai Air Force	330
15-16 Nov 1962	Bangkok	Royal Thai Army	225
19-21 Nov 1962	Sattahip	Royal Thai Marine Corps	610
28 Nov 1962	Bangkok	Royal Thai Army	171
6-11 Feb 1963	Chiengmai	Royal Thai Army	271
21-22 Feb 1963	Haad Yai	Royal Thai Army	234
13-15 Mar 1963	Ubol	Royal Thai Army	318
			<hr/> 2,950

c. Locations of Measuring

Military personnel were measured at ten locations in Thailand during the survey. Five of these locations were Royal Thai Army installations in Bangkok. Royal Thai Air Force personnel were measured at Don Muang airfield, 29 kilometers north of Bangkok. Royal Thai Marine Corps personnel were measured at the Royal Thai Naval Station at Sattahip, located on the Gulf of Thailand approximately 170 kilometers southeast of Bangkok. Additional personnel were subsequently measured at three Royal Thai Army posts located at Haad Yai, near Songkhla in the south; at Ubol in the east; and at Chiengmai in the north. (See map, Figure 1).

On the basis of geographical distribution, a large Army sample, or 40 percent of the total series, was measured in Bangkok while three smaller Army samples comprising 28 percent of the total series were measured in the south, east and north of Thailand. The Air Force and Marine Corps samples, eleven and 21 percent of the total series respectively, were measured near Bangkok. A summary of the locations of measuring and the number of men measured at each location is given in Table 3.2.

Table 3.2. Locations of Measuring

<u>Location</u>	<u>Service</u>	<u>Unit</u>	<u>Number</u>	<u>Percent</u>
Bangkok	RTA	1st Inf Div, 1st Rgt, 2nd Bn	253	8.6
Bangkok	RTA	1st Inf Div, 1st Rgt, 3rd Bn	269	9.1
Bangkok	RTA	1st Inf Div, 1st Rgt, 4th Bn	150	5.1
Bangkok	RTA	1st Inf Div, 11th Rgt	344	11.6
Bangkok	RTA	Transportation Corps	171	5.8
Don Muang	RTAF	1st Wing	330	11.2
Sattahip	RTMC	Marine Corps	610	20.7
Haad Yai	RTA	5th Regimental Combat Team	234	7.9
Ubol	RTA	6th Regimental Combat Team	318	10.8
Chiengmai	RTA	7th Regimental Combat Team	271	9.2
TOTAL			2,950	100.0

d. Background Information

(1) Age

The information on age for the series of men measured in Thailand is summarized in Table 3.3 while the distribution of age is given in Table 3.4. The statistical terms of mean, standard deviation (S. D.) and co-efficient of variation (V) are discussed in Section 4c.

Mean age for the total series was 24 years, with a standard deviation of four years. Although the range of age for the total series was from 17 to 52 years, 62.7 percent of the series were 21 and 22 years old. The sample of Marine Corps personnel had the lowest mean age, 22 years, and the lowest standard deviation, 1.8 years; 59.1 percent of the Marines were 21-and 22-year old men. The Army sample had a mean age of 24.2 years, with 70.7 percent concentrated in the 21-22 year age group. The Air Force sample showed the highest mean age of 26.8 years. This group included 22 officers with a mean age of 28.7 years; these were the only officers measured during the survey. The mean age of the Air Force series of 308 men, excluding officers, was 26.7 years.

Table 3.3. Summary of Age

	<u>Army</u>	<u>Marine Corps</u>	<u>Air Force</u>	<u>Total Series</u>
Range (years)	18-52	17-32	19-46	17-52
Mean (years)	24.2	22.0	26.8	24.0
S. D. (years)	4.2	1.8	4.4	4.0
V (%)	17.4	8.2	16.4	16.7
Number of men	2,010	610	330	2,950

Table 3.4. Distribution of Age

<u>Age</u> (years)	<u>Army</u>		<u>Marine Corps</u>		<u>Air Force</u>		<u>Total Series</u>	
	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>
17	---	---	4	0.7	---	---	4	0.1
18	6	0.3	25	4.1	---	---	31	1.1
19	5	0.3	57	9.3	1	0.3	63	2.1
20	12	0.6	39	6.4	7	2.1	58	2.0
21	671	33.4	146	23.9	50	15.1	867	29.4
22	750	37.3	215	35.2	17	5.2	982	33.3
23	65	3.2	84	13.8	22	6.7	171	5.8
24	27	1.3	15	2.5	19	5.8	61	2.1
25	28	1.4	10	1.6	30	9.1	68	2.3
26	23	1.1	7	1.1	30	9.1	60	2.0
27	38	1.9	3	0.5	21	6.4	62	2.1
28	41	2.0	2	0.3	43	13.0	86	2.9
29	39	1.9	1	0.2	30	9.1	70	2.4
30	94	4.7	1	0.2	26	7.9	121	4.1
31	75	3.7	---	---	7	2.1	82	2.8
32	43	2.1	1	0.2	8	2.4	52	1.8
33	27	1.3	---	---	3	1.9	30	1.0
34	21	1.0	---	---	3	0.9	24	0.8
35	15	0.8	---	---	3	0.9	18	0.6
36	10	0.5	---	---	2	0.6	12	0.4
37	1	0.1	---	---	1	0.3	2	0.1
38	6	0.3	---	---	---	---	6	0.2
39	3	0.1	---	---	1	0.3	4	0.1
40	---	---	---	---	2	0.6	2	0.1
41	2	0.1	---	---	---	---	2	0.1
42	5	0.3	---	---	---	---	5	0.2
43	1	0.1	---	---	---	---	1	---
44	---	---	---	---	1	0.3	1	---
45	---	---	---	---	2	0.6	2	0.1
46	---	---	---	---	1	0.3	1	---
47	1	0.1	---	---	---	---	1	---
-								
52	1	0.1	---	---	---	---	1	---
TOTAL	2010	100.0	610	100.0	330	100.0	2950	100.0

(2) Geographical Distribution

There are four natural regions based on the pattern of rivers and mountains in Thailand. These are the Central Plain, formed by the basin of the Chao Phraya River; the East, consisting of the Khorat Plateau area; the North, an area of hills and valleys; and the South, the region of the peninsula. However, for convenience the 71 provinces or changwats of Thailand are grouped into nine geographical regions. These regions are those utilized for administrative purposes, primarily by the Ministry of the Interior. The nine regions and the provinces included in each region are listed in Table 3.5. The provinces have the same names as their provincial capitals, with the exception of Pra Nakorn province whose capital is Bangkok. The nine regions, which are numbered counter-clockwise from Bangkok, have been designated by their approximate directions from Bangkok and are shown in the outline map in Figure 1.

Region One (Central) consists of eleven comparatively small provinces in the central part of Thailand at the head of the Gulf of Thailand. Bangkok, the capital and largest city of the country, is located in Pra Nakorn province and dominates this area of low-lying flood plain and high population density. Region Two (Southeast), containing seven provinces, is in the southeastern part of the country bordering Cambodia and the Gulf. Regions Three and Four are in the Khorat Plateau area of eastern Thailand. Region Three (East), with six provinces, forms the southern portion, and Region Four (Northeast), with nine provinces, forms the northern portion of this area. Region Five (North) consists of seven provinces in the north of Thailand characterized by high hills and deep valleys. Region Six (Northwest), with nine provinces, lies in the upper central valley area of the country. Region Seven (West), consisting of eight provinces, is located to the west of the central area, along the border with Burma. Region Eight (Southwest), with seven provinces, lies in the narrow southern extension of Thailand in the Isthmus of Kra area. Region Nine (South) comprises seven provinces in the extreme southern part of the country, bordering Malaysia.

Table 3.5. Provincial Regions of Thailand

Region 1 - Central (11 provinces)

Chainat
Singburi
Lopburi
Angthong
Saraburi
Ayudhya
Patumtani
Nonburi
Thonburi
Pra Nakorn (Bangkok)
Samutprakarn

Region 2 - Southeast (7 provinces)

Nakorn Nayok
Prachinburi
Chacheongsao
Cholburi
Rayong
Chantaburi
Trad

Table 3.5 (continued)

Region 3 - East (6 provinces)

Chaiyaphum
Nakornrajsima
Buriram
Surin
Srisaket
Ubol

Region 4 - Northeast (9 provinces)

Luey
Nongkai
Udorn
Sakonnakorn
Nakornpanom
Khongkaen
Mahasarakam
Kalasin
Roi-Et

Region 5 - North (7 provinces)

Mae Hongson
Chiangmai
Lampoon
Chiangrai
Lampang
Prae
Nan

Region 6 - Northwest (9 provinces)

Tak
Sukhothai
Uttaradit
Pitsanuloke
Kampanpet
Pichit
Petchaboon
Uthaitani
Nakornsawan

Region 7 - West (8 provinces)

Kanjanaburi
Supanburi
Nakornpathom
Ratburi
Samutsonggram
Samutsakorn
Petchburi
Prachuabkirakhan

Region 8 - Southwest (7 provinces)

Chumpon
Ranong
Pangnga
Surathani
Phuket
Krabi
Nakornsri thamaraaj

Region 9 - South (7 provinces)

Trang
Pattalung
Satul
Songkhla
Pattani
Yala
Narathivas

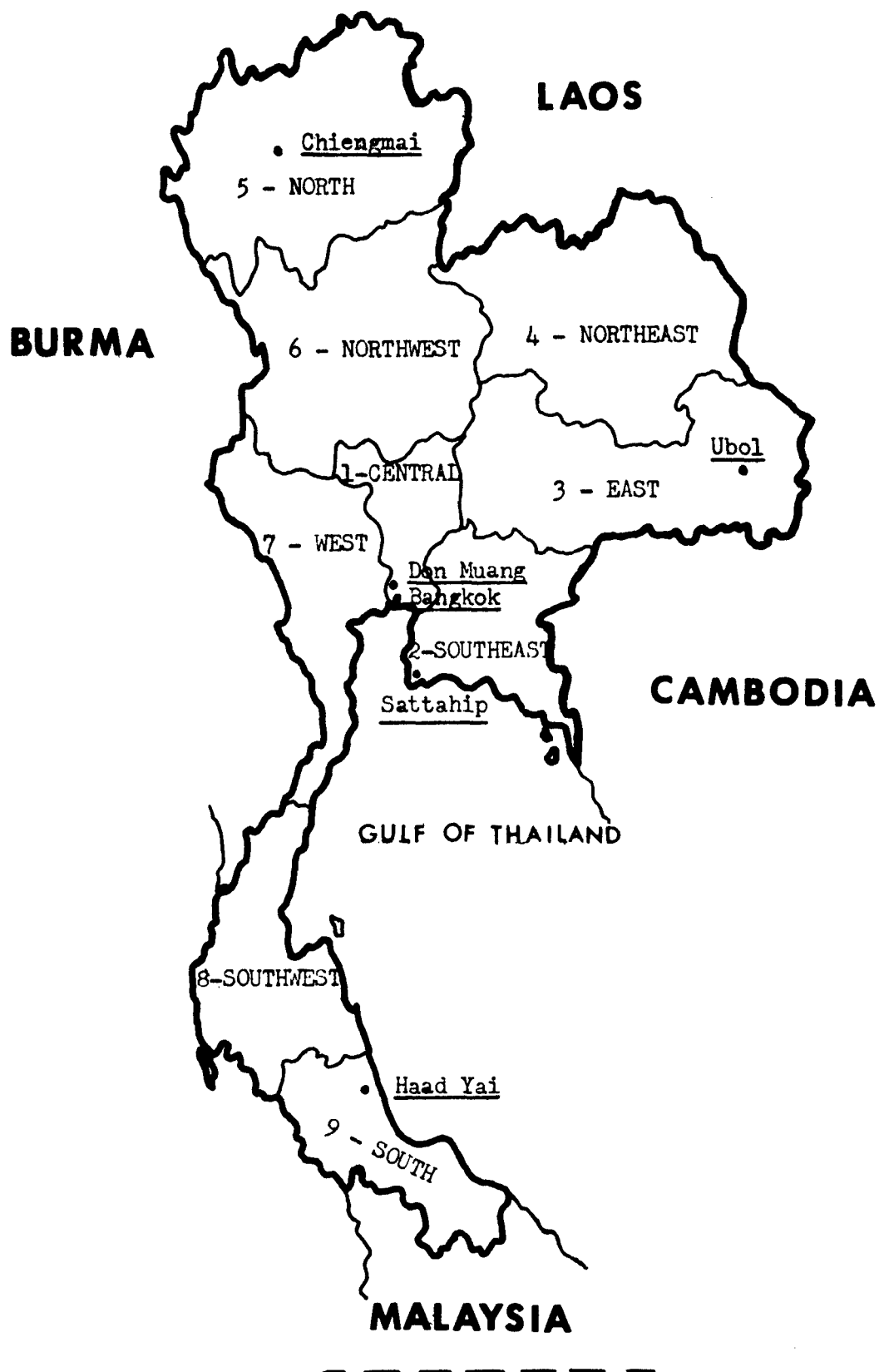


Figure 1. Provincial regions of Thailand

According to reports based upon the 1957 census, the population of Thailand was 22,800,000. A United Nations estimate of 1961 gives the population as 27,181,000. The population is concentrated mainly in the river valleys. The entire southern portion of the Central Plain around Bangkok and Thonburi is the most thickly populated area, followed closely by the northern portion of the Central Plain around Lopburi and Singburi. Other areas of relatively high population concentration are the valleys of the Chi and Mun Rivers in the Khorat Plateau region in the east, and the Chiangmai area of the north, as well as portions of the east coast in the south of Thailand, particularly between Nakornsri thammaraj and Songkhla and between Pattani and Narathivas. Bangkok, the capitol, is the largest city in Thailand with a population of 1,330,153. Thus, about five percent of the population of Thailand is concentrated in Bangkok.

Average population density in Thailand is about 137 persons per square mile. However, in areas of high population concentration, such as in the river valleys, the density is over 200 per square mile. Since only about 18 percent of the total area is cultivated, there is more significance in the average density per cultivated square mile, which is near 550. The Chao Phraya valley has over 600 persons per square mile of cultivated land, and some sections of the narrow south-east coastal area have over 3,000.

The population densities for the nine geographical regions discussed above are not available. However, based upon the population densities of the 71 provinces, it is estimated that Region One has the highest population density, while Regions Four and Seven have medium densities. Population densities in the other six regions are relatively lower.

The geographical distribution of the series of men measured in Thailand may be assessed by examining the information on birthplace and home which were recorded when the men were measured. Locations of birthplace and home were recorded by province rather than by city or town. The geographical distribution of birthplace is shown in Table 3.6.

Table 3.6. Geographical Distribution of Birthplace

<u>Region</u>	<u>Army</u>		<u>Marine Corps</u>		<u>Air Force</u>		<u>Total Series</u>	
	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>
1 - Central	786	39.1	127	20.8	185	56.1	1098	37.2
2 - Southeast	101	5.0	291	47.7	22	6.7	414	14.0
3 - East	343	17.1	13	2.1	19	5.7	375	12.7
4 - Northeast	12	.6	9	1.5	5	1.5	26	1.0
5 - North	275	13.7	1	.2	5	1.5	281	9.5
6 - Northwest	14	.7	10	1.7	23	7.0	47	1.6
7 - West	241	12.0	113	18.5	64	19.4	418	14.2
8 - Southwest	5	.2	44	7.2	5	1.5	54	1.8
9 - South	233	11.6	2	.3	2	.6	237	8.0
TOTAL	2010	100.0	610	100.0	330	100.0	2950	100.0

About 37 percent of the total series of men measured in Thailand were born in Region One, while about two-thirds (or 65.4 percent) were from the central part of the country comprising Regions One, Two and Seven. A smaller group of the total series (30.2 percent) came from Regions Three, Five and Nine; the majority of these individuals were Army men measured at Ubol in the east, at Chiangmai in the north and at Haad Yai in the south. Only 4.4 percent of the total series were born in Regions Four, Six and Eight.

In the Army sample, 56.1 percent were born in the central part of the country (Regions 1, 2, 7), 42.4 percent were from Regions 3, 5 and 9 and only 1.5 percent were from the remaining three regions. Most of the Marine Corps personnel (87 percent) were born in the central area of Regions 1, 2 and 7, with the remaining 13 percent from the rest of Thailand. Three fourths (75.5 percent) of the Air Force sample were born in Regions 1 and 7, with 24.5 percent from the rest of the country.

In summary, the geographical distribution of Thai military personnel with respect to birthplace shows that two-thirds of the series were from the central area of the country (Regions 1, 2, 7). Thirty percent were from the east, north and south (Regions 3, 5, 9). Less than five percent of the series were from the northeast, northwest and southwest (Regions 4, 6, 8). Data are not available upon which to base specific correlations between regional population densities and samples of military personnel from the nine geographical regions. However, it may be noted that the series of military personnel measured in Thailand is deficient in numbers of men from the northeast, the northwest and the southwest.

In addition to birthplace, the home province was recorded for each man. Originally, it was intended that this information would refer to the man's home or residence prior to entry into military service. However, it is believed that most responses indicate the man's present residence, thus corresponding to the area of his military assignment rather than to his home. The geographical distribution of home or residence is shown in Table 3.7. Of the total series, 68.2 percent recorded their home province in the central area of Regions 1, 2 and 7. The home province was listed by 29 percent as in the east, north or south (Regions 3, 5, 9), while only 2.8 percent listed their home province in Regions 4, 6 or 8.

Table 3.7. Geographical Distribution of Home

<u>Region</u>	<u>Army</u>		<u>Marine Corps</u>		<u>Air Force</u>		<u>Total Series</u>	
	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>
1 - Central	847	42.1	133	21.8	313	94.9	1293	43.8
2 - Southeast	97	4.8	302	49.5	4	1.2	403	13.7
3 - East	336	16.7	11	1.8	1	.3	348	11.8
4 - Northeast	11	.6	4	.7	---	---	15	.5
5 - North	273	13.6	2	.3	---	---	275	9.3
6 - Northwest	11	.6	9	1.5	3	.9	23	.8
7 - West	199	9.9	108	17.7	9	2.7	316	10.7
8 - Southwest	2	.1	41	6.7	---	---	43	1.5
9 - South	234	11.6	---	---	---	---	234	7.9
TOTAL	2010	100.0	610	100.0	330	100.0	2950	100.0

The correspondence between birthplace and home may be seen in Table 3.8. There are two possible interpretations of the information in this table. One is that there is a close correlation between the birthplaces and homes of military personnel in Thailand. If, however, "home" is an indication of a man's military assignment, it is apparent that men tend to be assigned to the area in which they were born.

Table 3.8. Geographical Distribution of Birthplace and Home

<u>Birthplace</u> <u>(region)</u>	<u>(Home (region))</u>									<u>Total</u>
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	
1 - Central	1085	7				2	4			1098
2 - Southeast	25	388					1			414
3 - East	28	1	346							375
4 - Northeast	7	2	1	15		1				26
5 - North	7				274					281
6 - Northwest	25	2			1	19				47
7 - West	106	2					309			418
8 - Southwest	7	1	1				1	43	1	54
9 - South	3					1	1		232	237
TOTAL	1293	403	348	15	275	23	316	43	234	2950

(3) Religion

The traditional religion of Thailand is Theravada Buddhism, which is also known as Hinayana or Southern Buddhism. Over 90 percent of Thais are Buddhists. The largest religious minority in Thailand consists of Moslems who are concentrated in the south adjacent to Malayasia. Some additional Moslems are scattered in small groups in central and northern Thailand.

The distribution of religion for the series of military personnel measured in Thailand is shown in Table 3.9. In the total series, about 94 percent were Buddhists and six percent were Moslems. Two-thirds of the men listed as Moslem were born in the southern provinces of Region 9.

Table 3.9. Religion

<u>Religion</u>	<u>Army</u>		<u>Marine Corps</u>		<u>Air Force</u>		<u>Total Series</u>	
	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>
Buddhist	1836	91.4	604	99.0	322	97.6	2762	93.7
Moslem	169	8.4	6	1.0	6	1.8	181	6.1
Christian	5	.2	---	---	2	.6	7	.2
TOTAL	2010	100.0	610	100.0	330	100.0	2950	100.0

(4) Military Service, Branch and Unit

The series of military personnel measured during the anthropometric survey of Thailand included representatives of the Royal Thai Army, Marine Corps and Air Force. The Army sample of 2,010 men comprised 68 percent of the total series. The Marine Corps sample of 610 men represented about 21 percent of the series, while the Air Force sample of 330 men represented about 11 percent of the total series. Although no Navy personnel as such were measured during the survey, the sample of Marine Corps personnel may be considered to represent the Navy since the Marine Corps is an integral part of the Royal Thai Navy. It was requested that military personnel of all ages and ranks be measured during the survey. No selection of personnel was made in that all men made available by their commanding officers were measured.

With respect to branch of service, approximately half of the Army sample (or 1,016 men) consisted of infantrymen of the First Infantry Division measured in the Bangkok area. A small sample of 171 men of the Army's Transportation Corps also was measured in Bangkok. Army personnel of the three Regimental Combat Teams measured at Haad Yai, Ubol and Chiangmai were predominantly infantrymen, although some artillery and service personnel also were included. The Marine Corps sample included infantry personnel, a few artillerymen and a group of petty officer cadets in training. The Air Force personnel, drawn from the First and

Sixth Wings, included both flight personnel and air crews, as well as ground personnel. A summary of military personnel measured during the survey is shown in Table 3.10, while a list of the various military units which supplied men for the survey is given in Table 3.11.

Table 3.10. Distribution by Service

<u>Service</u>	<u>Unit</u>	<u>Location</u>	<u>No. of Men</u>	
			<u>No.</u>	<u>%</u>
Royal Thai Army				
Infantry	First Division	Bangkok	1016	34.4
Infantry	5th Regt Combat Team	Haad Yai	234	7.9
Infantry	6th Regt Combat Team	Ubol	318	10.8
Infantry	7th Regt Combat Team	Chiengmai	271	9.2
Transportation Corps		Bangkok	171	5.8
		Total Army	2010	68.1
Royal Thai Marine Corps		Sattahip	610	20.7
Royal Thai Air Force		Don Muang	330	11.2
		Total	2950	100.0

Table 3.11. Military Units Sampled

<u>Unit</u>	<u>Number of Men</u>	
Royal Thai Army		
First Infantry Division (Bangkok)	1016	
1st Infantry Regiment	673	
1st Infantry Battalion		205
2nd Infantry Battalion		177
3rd Infantry Battalion		141
4th Infantry Battalion		150
11th Infantry Regiment	343	
1st Infantry Battalion		199
2nd Infantry Battalion		144
Fifth Regimental Combat Team (Haad Yai)	234	
5th RCT		28
3rd Infantry Battalion		134
6th Engineer Battalion, 1st Company		19
Service Company		21
Heavy Weapons Company		18
Medical personnel		14
Sixth Regimental Combat Team (Ubol)	318	
1st Infantry Battalion		40
2nd Infantry Battalion		83
3rd Infantry Battalion		95
6th Artillery Battalion		100

Seventh Regimental Combat Team (Chiengmai)	271	
7th RCT		86
Headquarters, Chiengmai		47
1st Training Company		58
7th Artillery Battalion		80
Transportation Corps (Bangkok)	171	
Transportation Battalion		81
Boat Company		90
Royal Thai Marine Corps (Sattahip)	610	
Headquarters Battalion		168
1st Infantry Battalion		152
3rd Infantry Battalion		119
Artillery Battalion		30
Marine Corps Education Center		141
Royal Thai Air Force (Don Muang)	330	
1st Wing		264
6th Wing		66
TOTAL	2950	

(5) Rank

Most of the military personnel measured during the anthropometric survey of Thailand were enlisted men, comprising 94.9 percent of the total series. Non-commissioned officers made up 4.3 percent of the total series. The only officers measured were Air Force personnel; these 22 pilots and navigators comprised 0.8 percent of the total series.

Distribution of rank is shown separately for the Army, Marine Corps and Air Force in Tables 3.12, 3.13 and 3.14 respectively. In these tables the Thai rank is given, followed by an approximate English translation of the term. For comparison the approximately equivalent United States Army, Marine Corps or Air Force ranks also are included.

The largest group of Army men measured were recruits; 75.3 percent of the Army sample were of this rank. Another 23.2 percent of the Army sample were enlisted men. While the translations of the three ranks in this group are given as senior, intermediate and junior private they could also be called sergeant, corporal and private first class since these men wear three, two or one stripes, respectively. Only 1.5 percent of the Army sample were non-commissioned officers or "first three graders" in U. S. Army terms.

In the Marine Corps sample, 21.0 percent were petty officer cadets who were in training. A large group of Marines (68.5 percent) were recruits, while the remaining 10.5 percent were petty officers.

In the Air Force sample 63.9 percent were enlisted airmen, while 29.4 percent were non-commissioned officers. Twenty-two officers were measured, comprising 6.7 percent of the Air Force sample.

Table 3.12. Royal Thai Army Ranks

<u>Thai Rank</u>	<u>Translation</u>	<u>U. S. Army Equivalent</u>	<u>No.</u>	<u>%</u>
Cha Nai Sip	Superior NCO	Sergeant Major (E9)	---	---
Cha Sip Ek	Senior NCO	Sergeant 1st Class (E7)	20	1.0
Cha Sip Tho	Intermediate NCO	Staff Sergeant (E6)	5	0.2
Cha Sip Tri	Junior NCO	Sergeant (E5)	6	0.3
Sip Ek	Senior Private	Corporal (E4)	190	9.4
Sip Tho	Intermediate Private	Private 1st Class (E3)	154	7.7
Sip Tri	Junior Private	Private (E2)	122	6.1
Phon Tahan	Recruit or Soldier	Recruit or Private (E1)	1513	75.3
TOTAL			2010	100.0

Table 3.13. Royal Thai Marine Corps Ranks

<u>Thai Rank</u>	<u>Translation</u>	<u>USMC Equivalent</u>	<u>No.</u>	<u>%</u>
Phan Cha Ek	Chief P.O. 1st Class	Gunnery Sergeant (E7)	---	---
Phan Cha Tho	Chief P.O. 2nd Class	Staff Sergeant (E6)	---	---
Phan Cha Tri	Chief P.O. 3rd Class	Sergeant (E5)	---	---
Cha Ek	Petty Ofcr 1st Class	Corporal (E4)	33	5.4
Cha Tho	Petty Ofcr 2nd Class	Lance Corporal (E3)	30	5.0
Cha Tri	Petty Ofcr 3rd Class	Private 1st Class (E2)	1	.1
Phon Tahan (Rua)	Recruit (seaman)	Private (E1)	418	68.5
Nak Rien Cha	Petty Officer Cadet	None	128	21.0
TOTAL			610	100.0

Table 3.14. Royal Thai Air Force Ranks

<u>Thai Rank</u>	<u>Translation</u>	<u>USAF Equivalent</u>	<u>No.</u>	<u>%</u>
Officers:				
Rua Arkas Ek	Flight Lieutenant	Captain	1	.3
Rua Arkas Tho	Flying Officer	1st Lieutenant	16	4.9
Rua Arkas Tri	Pilot Officer	2nd Lieutenant	5	1.5
Enlisted Men:				
Phan Cha Arkas Ek	Senior NCO	Master Sergeant	(E7) 61	18.5
Phan Cha Arkas Tho	Intermediate NCO	Technical Sergeant	(E6) 33	10.0
Phan Cha Arkas Tri	Junior NCO	Staff Sergeant	(E5) 3	.9
Cha Arkas Ek	Airman 1st Class	Airman 1st Class	(E4) 143	43.3
Cha Arkas Tho	Airman 2nd Class	Airman 2nd Class	(E3) 27	8.2
Cha Arkas Tri	Airman 3rd Class	Airman 3rd Class	(E2) 1	.3
Phon Tahan (Arkas)	Recruit (airman)	Airman	(E1) 40	12.1
TOTAL			330	100.0

(6) Military Duty or Specialty

The military duties of Thai personnel measured during the survey covered a wide range of assignments or specialties. Although some difficulties were encountered in translating the duty designations from Thai into English, it was possible to group personnel into general occupational categories. These groupings are summarized in Table 3.15.

Personnel of the Royal Thai Army may be classified as infantry or non-infantry on the basis of their military assignments. Three categories are shown under infantry: headquarters, rifle platoon and weapons platoon personnel. Headquarters personnel are those assigned to administration, communications, messing, supply and transportation duties. Rifle platoon personnel are primarily men designated as riflemen, automatic riflemen, or machine gunner, while weapons platoon personnel are trained in the use of recoilless rifles or mortars. The largest group of non-infantry personnel are designated as recruits or trainees, while smaller samples of artillery, transportation, medical and miscellaneous personnel also are included. The sample of Royal Thai Army personnel also may be classified on the basis of combat or support assignments. On this basis, about 53 percent are combat personnel, and about five percent are support personnel, while 42 percent are recruits or trainees.

Table 3.15. Summary of Military Duty

<u>Royal Thai Army</u>	<u>Number</u>	<u>Percent</u>
Infantry:		
Headquarters	293	14.6
Rifle Platoon	511	25.4
Weapons Platoon	196	9.8
Non-Infantry:		
Recruits (Trainees)	841	41.8
Artillery	66	3.3
Transportation Corps	72	3.6
Medical Corps	7	0.3
Miscellaneous	24	1.2
TOTAL	<u>2,010</u>	<u>100.0</u>
<u>Royal Thai Marine Corps</u>		
Infantry (Riflemen)	466	76.4
Artillery	68	11.2
Communications	42	6.9
Engineers	20	3.3
Transportation (landing craft)	7	1.1
Reconnaissance	5	0.8
Medical	2	0.3
TOTAL	<u>610</u>	<u>100.0</u>
<u>Royal Thai Air Force</u>		
Flying Personnel	63	19.1
Ground Personnel	190	57.6
Support Personnel	77	23.3
TOTAL	<u>330</u>	<u>100.0</u>

The largest group of Royal Thai Marine Corps personnel in this survey were infantry riflemen. Over three-fourths of the Marines measured were assigned to this category. Other Marine Corps duty assignments are shown in Table 3.15.

The Royal Thai Air Force sample measured in the survey included flying, ground and support personnel. Flying personnel included the duties of pilot, navigator, flight engineer, radio operator and crew chief. A total of 29 pilots was measured; fifteen were officers and fourteen were non-commissioned officers. Five navigators also were officers, while the other flying personnel were NCOs or Airmen 1st Class. Air Force ground personnel included mechanics, armorers and radio and radar technicians. The support category consisted of individuals assigned to administrative duties such as supply, finance, transportation or guards.

(7) Length of Military Service

The length of military service among Thai personnel measured during the survey ranged from a few months for 21-year-old recruits to as much as 31 years in the case of a 52-year-old Army sergeant. The distribution of length of service is given in Table 3.16 and is summarized in Table 3.17. In the total series 38 percent had been in service from one to eleven months while 31 percent had been in service from twelve to 23 months. Thus, 69 percent of the total series had less than two years of military service, and 31 percent had between two and 31 years of service.

Table 3.16. Length of Military Service

<u>Duration</u>	<u>Army</u>	<u>Marine Corps</u>	<u>Air Force</u>	<u>Total Series</u>
1- 2 months	291	---	40	331
3- 5 months	183	58	--	241
6- 8 months	210	93	--	303
9-11 months	185	61	--	246
12-14 months	323	71	3	397
15-17 months	245	155	--	400
18-20 months	42	55	--	97
21-23 months	11	3	--	14
2 years	27	61	5	93
3 years	35	9	19	63
4 years	40	6	23	69
5 years	32	19	40	91
6 years	22	7	21	50
7 years	35	4	32	71
8 years	99	2	24	125
9 years	68	3	28	99
10 years	81	2	39	122
11 years	36	1	18	55
12 years	16	---	12	28
13 years	12	---	8	20
14 years	1	---	6	7
15 years	6	---	2	8
16 years	1	---	--	1
17 years	---	---	1	1
18 years	---	---	1	1
19 years	1	---	4	5
20 years	---	---	--	---
21 years	4	---	--	4
22 years	1	---	1	2
23 years	2	---	1	3
24 years	---	---	1	1
25 years	---	---	--	---
26 years	---	---	1	1
31 years	1	---	--	1
TOTAL	2010	610	330	2950

Table 3.17. Summary of Length of Service

<u>Duration</u>	<u>Army</u>		<u>Marine Corps</u>		<u>Air Force</u>		<u>Total Series</u>	
	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>
1-11 months	869	43.2	212	34.7	40	12.1	1121	38.0
12-23 months	621	30.9	284	46.6	3	.9	908	30.8
2-31 years	520	25.9	114	18.7	287	87.0	921	31.2
TOTAL	2010	100.0	610	100.0	330	100.0	2950	100.0

4. RESULTS OF THE SURVEY

a. Description of Measurements

For ready reference by users of this report, brief descriptions of the 52 measurements taken during the survey in Thailand are given below. The measurements are listed in the order of presentation of the data, rather than the order in which they were taken on the men. Sketches illustrating the measurements may be found facing the tables of percentile values in Section 4,b.(Figures 2-5).

DESCRIPTION OF MEASUREMENTS

Subject Standing Erect (Figure 2):

1. Stature: Measured as distance from floor to top of head (vertex).
2. Shoulder Height: Measured as distance from floor to outer point of right shoulder (acromiale).
3. Waist Height: Measured as distance from floor to top of right hip bone (superior margin of ilium).
4. Crotch Height: Measured as distance from floor to crotch.
5. Kneecap Height: Measured as distance from floor to top of right kneecap (superior margin of patella).
6. Coat Length: Measured as distance from the level of the base of the neck (cervicale) to the level of first knuckle of the right thumb (base of proximal phalanx).
7. Hip Breadth, Standing: Measured as maximum breadth across the hips.

Subject Sitting Erect on Table or Bench (Figure 3):

8. Sitting Height: Measured as distance from table surface to top of head (vertex).
9. Eye Height, Sitting: Measured as distance from table surface to level of inner corner of right eye (right inner canthus).
10. Shoulder Height, Sitting: Measured as distance from table surface to outer point of right shoulder (acromiale).
11. Shoulder-Elbow Length: With right arm held to form a right angle at elbow, measured as distance from outer point of shoulder (acromiale) to elbow (olecranon process).
12. Forearm-Hand Length: With right arm held to form a right angle at elbow and with hand extended, measured as distance from elbow (olecranon process) to tip of middle finger (dactylion).
13. Buttock-Knee Length: With legs bent to form right angle at knee, measured as distance from rearmost projection of buttock to front of right kneecap.
14. Buttock-Popliteal Length: With legs bent to form right angle at knee, measured as distance from rearmost projection of buttock to back of right knee (medial head of gastrocnemius).
15. Knee Height, Sitting: With legs bent to form right angle at knee, measured as distance from surface of footrest to top of right knee.
16. Popliteal Height: With legs bent to form right angle at knee, measured as distance from surface of footrest to underside of right knee (tendon of biceps femoris).
17. Shoulder Breadth: Measured as maximum breadth across the shoulders, including upper arm muscles (between outermost projections of deltoids).
18. Hip Breadth, Sitting: Measured as maximum breadth across hips.
19. Arm Reach Upward: With right arm and hand extended vertically above shoulder, measured as distance from table surface to tip of middle finger (dactylion).
20. Arm Reach Forward: With right arm and hand extended horizontally in front of subject, measured as distance from back of shoulder (greatest bulge of trapezius) to tip of middle finger (dactylion).

Body Circumferences (Figure 4A):

21. Neck Circumference: Measured as maximum circumference of neck, with tape passing just below Adam's apple (thyroid cartilage).
22. Shoulder Circumference: Measured as maximum circumference of shoulders, with tape passing over bulge of both upper arm (deltoid) muscles.
23. Chest Circumference: Measured as circumference of chest during normal breathing, with tape at level of nipples.
24. Waist Circumference: Measured as circumference at level of umbilicus, with abdomen relaxed.
25. Hip Circumference: Measured as maximum circumference of hips at level of greatest buttock protrusion.
26. Upper Arm Circumference: Measured as circumference of right upper arm at level of biceps muscle (relaxed), mid-way between shoulder and elbow.
27. Wrist Circumference: Measured as minimum circumference of right wrist above protrusion of wrist bone (proximal to styloid processes).
28. Crotch-Thigh Circumference: Measured as circumference of the right upper thigh, with tape passing just below crease of buttock (gluteal furrow).
29. Lower Thigh Circumference: Measured as circumference of right lower thigh, with tape passing just above kneecap.
30. Calf Circumference: Measured as maximum circumference of right calf.
31. Ankle Circumference: Measured as minimum circumference of right ankle, with tape passing just above projections of ankle bones (malleoli).

Body Surface Measurements (Figure 4-B, C, D):

32. Back Waist Length: Measured as distance along surface of back from base of neck (cervicale) to level of waist (level of iliac crests).
33. Interscye Breadth: Measured as distance along surface of back between armpit creases.

- 34. Sleeve Inseam: With right arm extended and held away from side of body, measured as distance from front edge of right armpit (anterior margin of pectoralis major) to wrist (navicular).
- 35. Sleeve Length: With arms held horizontally, elbows bent and knuckles of fists pressed together, measured as distance along body surface from middle of back (spinal crease) over right elbow to wrist (middle of styloid process).

Head Measurements (Figure 5-A, B):

- 36. Head Length: Measured as maximum length of head from middle of forehead just above eyes (glabella) to back of head (posterior pole of occiput).
- 37. Head Height: Measured as distance from notch at front of right ear (tragion) to top of head (vertex).
- 38. Face Length: Measured as distance from depression of nose between eyes (nasion) to tip of chin.
- 39. Head Breadth: Measured as maximum breadth of head, above and behind ears.
- 40. Head Circumference: Measured as maximum circumference of head with tape passing over forehead above eyebrow ridges and just above both ears.
- 41. Interpupillary Distance: Measured as distance between centers of pupils of eyes.
- 42. Face Breadth: Measured as maximum breadth of face between outermost bulges of cheek bones (zygomatic arches).

Hand Measurements (Figure 5-C):

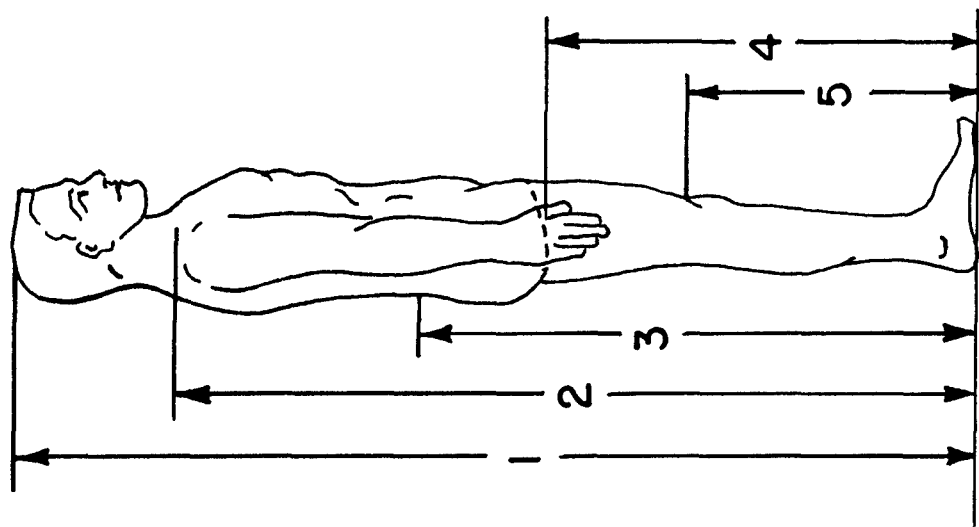
- 43. Hand Length: With right hand extended palm up and fingers straight, measured as distance from wrist (navicular) to tip of middle finger (dactylion).
- 44. Palm Length: With right hand extended palm up, measured as distance from wrist (navicular) to base of middle finger.
- 45. Hand Breadth: With right hand extended palm up, measured as maximum breadth across base of fingers (metacarpal-phalangeal joints).

Foot Measurements, Weight Equally Distributed on Both Feet (Figure 5-D, E):

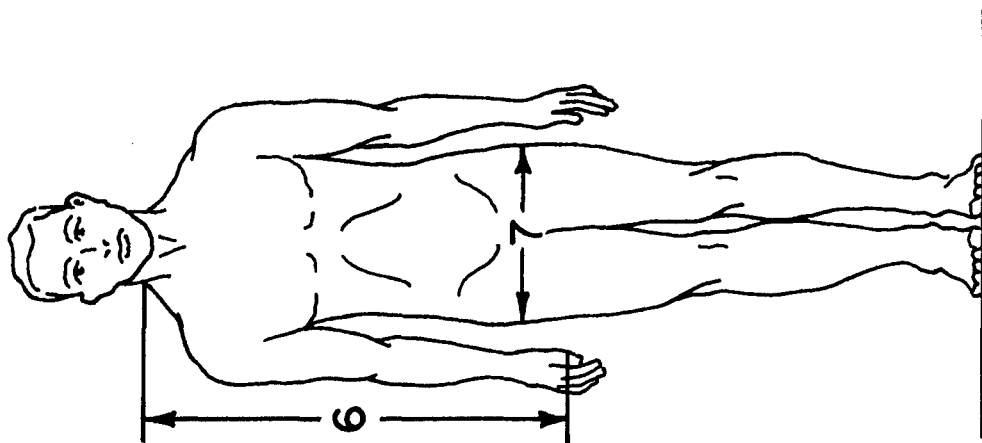
46. Foot Length: Measured as distance from back of right heel to tip of longest toe.
47. Instep Length: Measured as distance from back of right heel to inner ball of foot (first metatarsal-phalangeal joint).
48. Foot Breadth: Measured as maximum breadth of right foot.
49. Ball Foot Circumference: Measured as maximum circumference of foot at widest point (distal ends of metatarsals).
50. Heel Breadth: Measured as maximum breadth of right heel behind and below projections of ankle bones (malleoli).
51. Heel-Ankle Diagonal: Measured as diagonal circumference around right ankle, with tape passing under tip of heel and over instep at junction of foot and leg.
52. Weight: With subject dressed in undershorts, measured to nearest kilogram on spring platform scale.

b. Percentile Values

Presentation of anthropometric data in the form of percentile values is one of the most useful and practical methods for purposes of clothing and equipment sizing, design guidance and other human engineering applications. The data from this anthropometric survey are given in four tables (Tables 4.1 - 4.4) which show nine percentile values for each measurement. These data are based upon the total series of 2,950 men. The values are given in centimeters, with the exception of weight (No. 52) which is shown in kilograms. Facing each of the tables are sketches which indicate the location of each body measurement (Figures 2-5).



A



B

Figure 2. Standing measurements

Table 4.1. Percentiles of Standing Measurements
(values in centimeters)

STANDING MEASUREMENTS	PERCENTILES								
	1st	5th	10th	25th	50th	75th	90th	95th	99th
1 Stature	151.5	155.0	157.0	160.0	163.5	167.0	170.0	172.0	176.0
2 Shoulder Height	123.5	126.5	128.5	131.5	134.5	138.0	141.5	142.5	146.0
3 Waist Height	89.0	92.0	93.5	96.5	99.0	102.0	105.0	106.5	109.5
4 Crotch Height	66.5	69.0	70.5	73.0	75.5	78.0	80.5	82.0	84.5
5 Kneecap Height	43.5	45.5	46.5	48.0	50.0	51.5	53.0	54.5	56.0
6 Coat Length	55.0	58.0	59.5	62.0	65.0	67.5	70.0	72.0	75.0
7 Hip Breadth, Standing	26.5	27.5	28.0	29.0	30.0	31.0	32.0	32.5	33.5

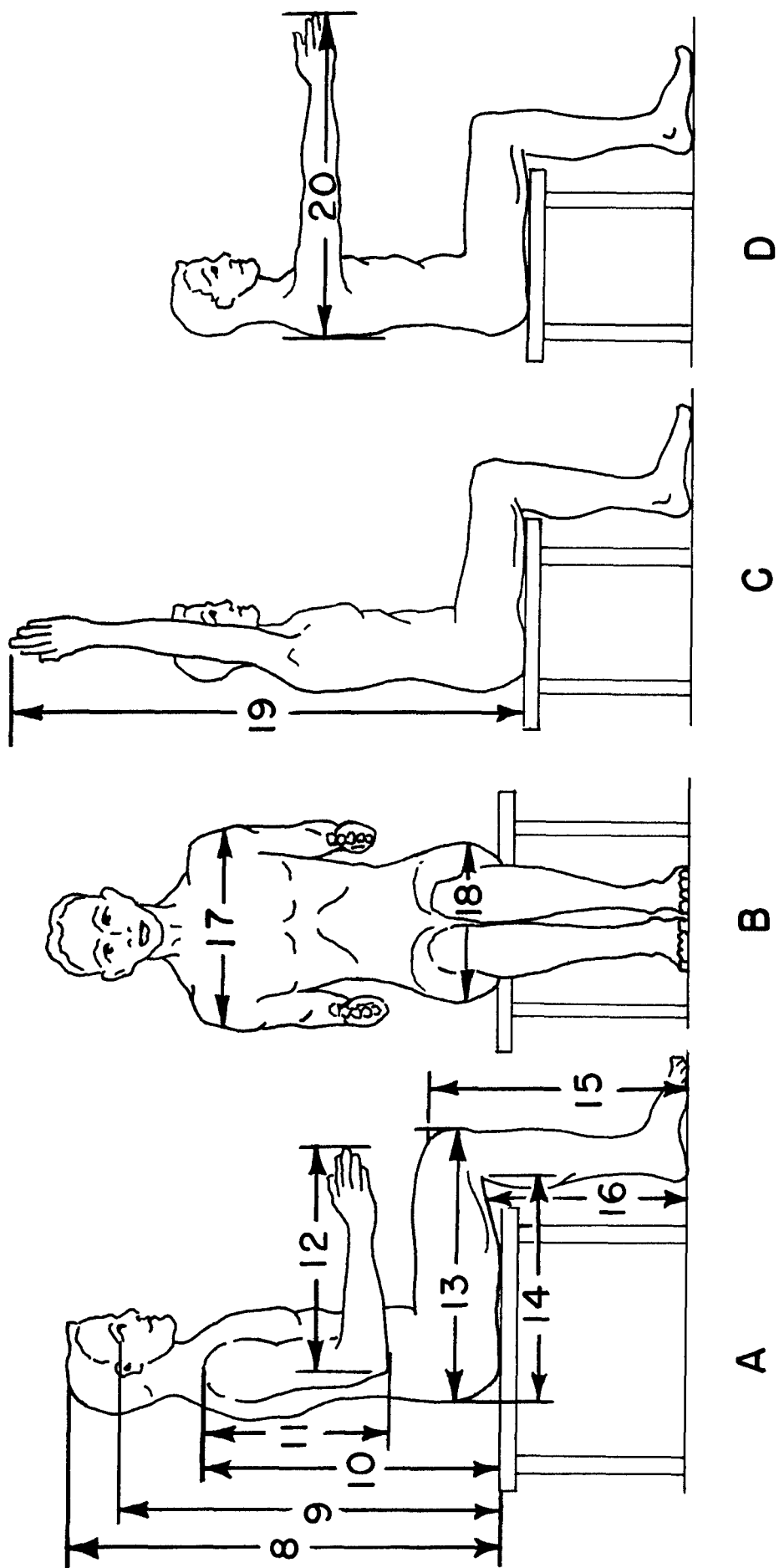


Figure 3. Sitting measurements

Table 4.2. Percentiles of Sitting Measurements
(values in centimeters)

PERCENTILES										
SITTING MEASUREMENTS		1st	5th	10th	25th	50th	75th	90th	95th	99th
8	Sitting Height	79.5	81.5	82.5	84.5	86.5	88.5	90.5	91.5	93.5
9	Eye Height, Sitting	67.5	70.0	71.0	73.0	75.0	77.0	79.0	80.0	82.0
10	Shoulder Height, Sitting	51.0	53.0	54.0	55.5	57.0	59.0	61.0	62.0	64.0
11	Shoulder-Elbow Length	31.0	32.0	32.5	33.5	35.0	36.0	37.0	37.5	39.0
12	Forearm-Hand Length	41.0	42.5	43.0	44.5	46.0	47.0	48.5	49.0	50.5
13	Buttock-Knee Length	48.0	50.0	50.5	52.5	54.0	55.5	57.0	58.0	59.5
14	Buttock-Popliteal Length	39.0	40.5	41.5	43.0	44.5	46.0	47.5	48.5	50.5
15	Knee Height, Sitting	46.0	47.5	48.0	49.5	51.0	52.5	53.5	54.5	56.0
16	Popliteal Height	38.0	39.5	40.0	41.5	43.0	44.0	45.0	46.0	47.0
17	Shoulder Breadth	37.0	38.5	39.0	40.0	41.5	43.0	44.0	45.0	47.0
18	Hip Breadth, Sitting	27.0	28.5	29.0	30.5	31.5	33.0	34.5	35.5	37.5
19	Arm Reach, Upward	120.0	123.5	125.0	128.0	131.5	134.5	137.5	139.0	142.0
20	Arm Reach, Forward	72.0	75.0	76.5	79.0	82.0	84.5	87.0	88.5	91.0

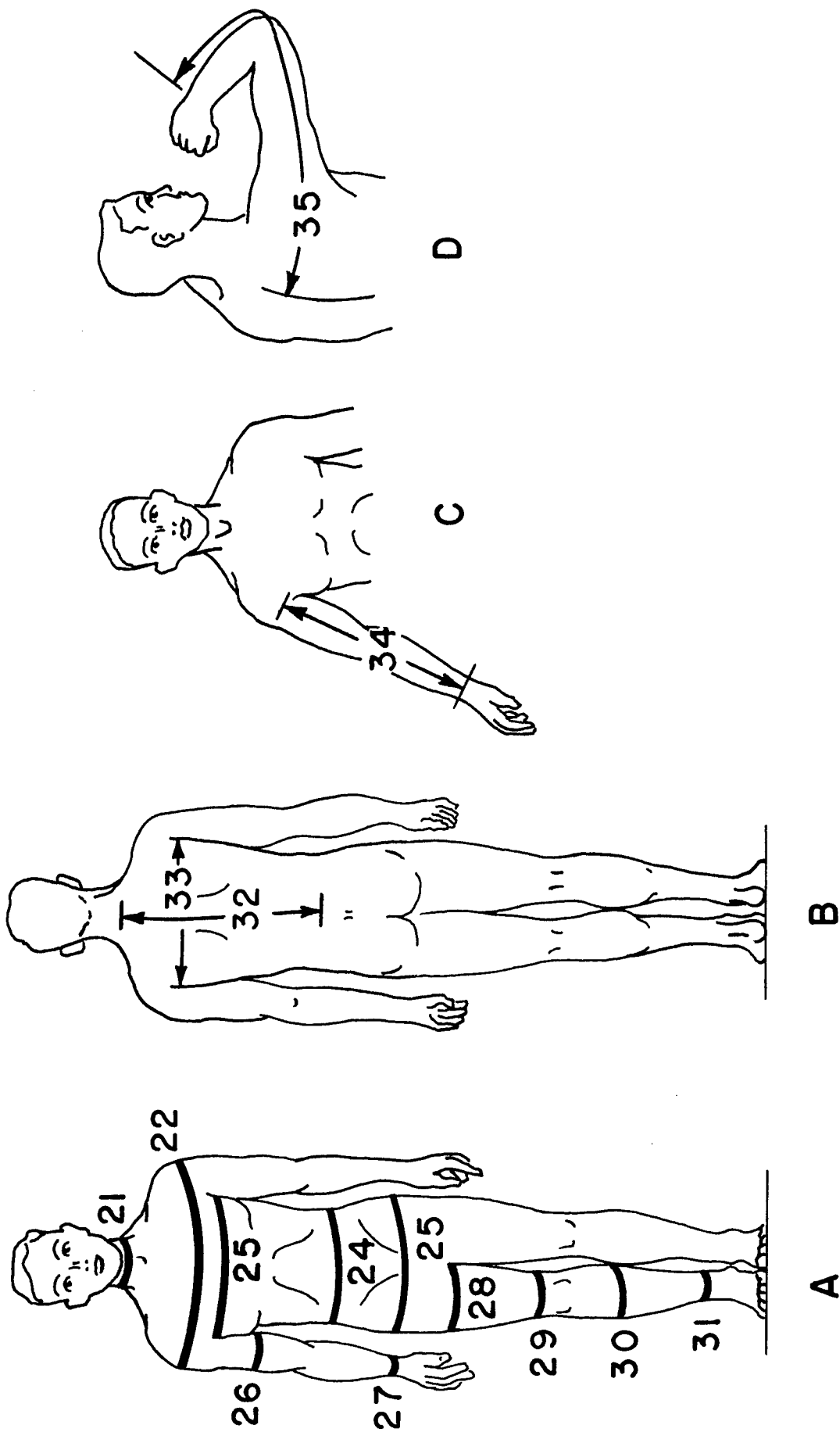
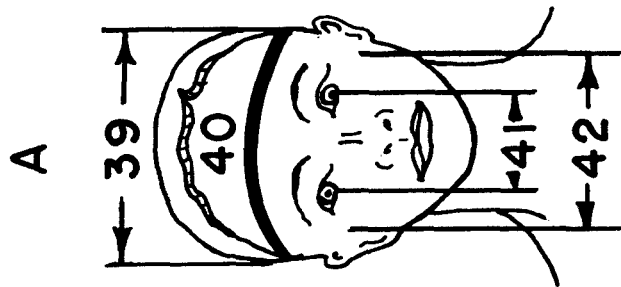
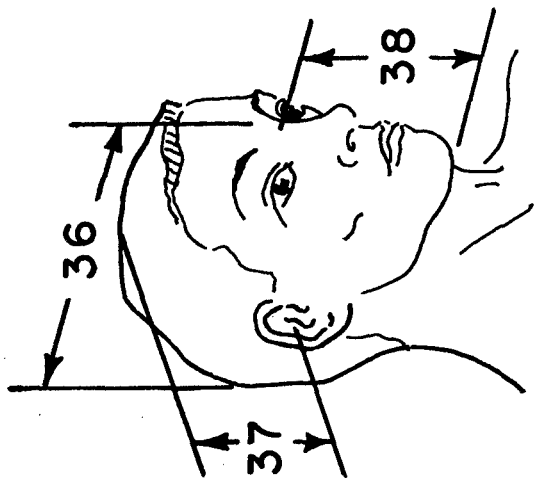


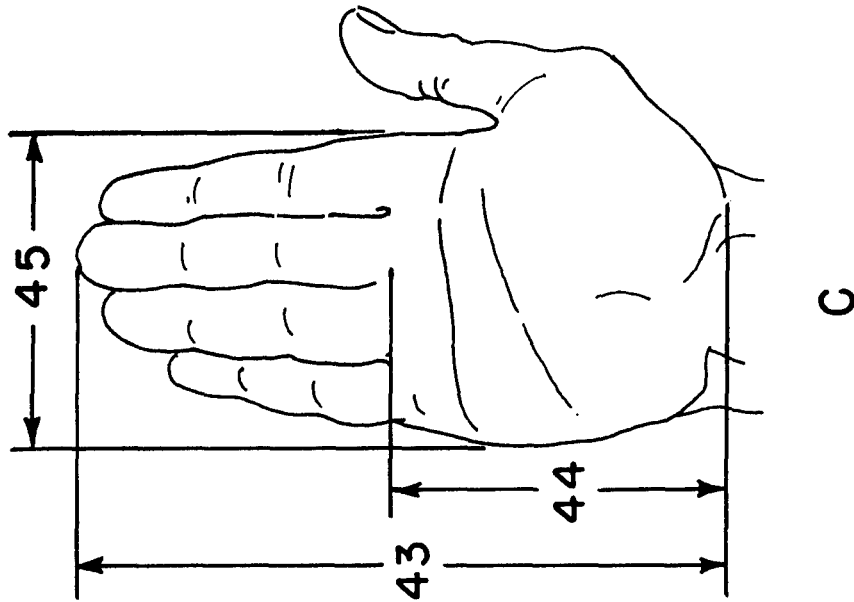
Figure 4. Body circumferences and surface measurements

Table 4.3. Percentiles of Circumferences and Surface Measurements
(values in centimeters)

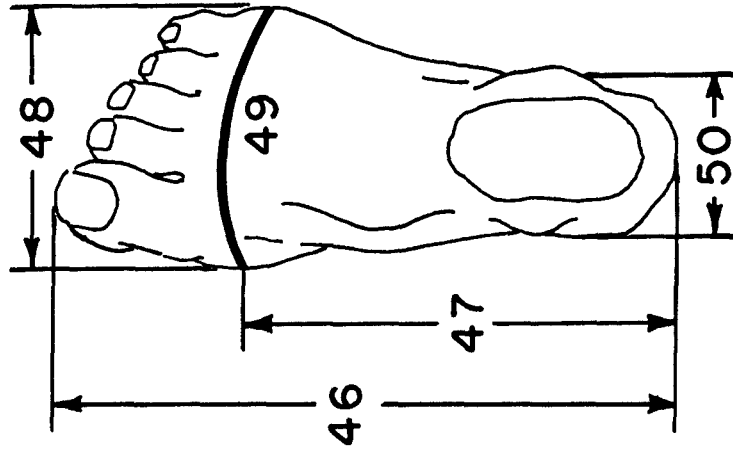
<u>PERCENTILES</u>										
<u>BODY CIRCUMFERENCES</u>		<u>1st</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>	<u>95th</u>	<u>99th</u>
21	Neck Circumference	30.4	31.3	31.8	32.7	33.7	34.7	35.8	36.4	37.8
22	Shoulder Circumference	95.0	97.5	99.0	101.5	104.0	107.0	110.0	112.0	117.0
23	Chest Circumference	76.0	78.5	80.0	82.0	85.0	87.5	90.0	92.0	96.0
24	Waist Circumference	60.0	62.5	64.0	66.0	69.0	72.5	76.0	78.0	84.0
25	Hip Circumference	78.0	80.0	81.5	83.5	86.0	89.0	91.5	93.5	97.5
26	Upper Arm Circumference	21.5	23.0	23.5	24.5	26.0	27.5	28.5	29.5	31.5
27	Wrist Circumference	13.7	14.3	14.6	15.1	15.6	16.2	16.7	17.0	17.7
28	Crotch Thigh Circum.	41.5	43.5	45.0	47.0	49.0	51.5	54.0	55.5	59.0
29	Lower Thigh Circum.	30.5	33.0	34.0	35.5	38.0	40.5	42.5	44.0	47.0
30	Calf Circumference	29.5	30.5	31.5	32.5	34.0	35.5	37.0	38.0	40.0
31	Ankle Circumference	18.4	19.1	19.5	20.2	20.9	21.6	22.4	22.8	23.8
<u>SURFACE MEASUREMENTS</u>										
32	Back Waist Length	36.5	38.5	39.5	41.0	43.0	45.0	46.5	47.5	50.0
33	Interscye Breadth	29.5	31.5	32.0	33.5	35.0	37.0	38.5	39.5	41.5
34	Sleeve Inseam	40.5	42.5	43.5	45.0	47.0	48.5	50.5	51.5	53.0
35	Sleeve Length	69.5	72.0	73.5	75.5	78.0	80.5	83.0	84.0	86.5



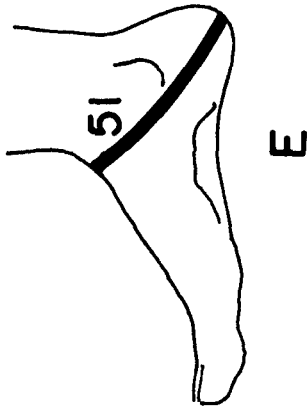
B



C



D



E

Figure 5. Head, hand and foot measurements

Table 4.4. Percentiles of Head, Hand and Foot Measurements
(values in centimeters)

		<u>PERCENTILES</u>								
<u>HEAD MEASUREMENTS</u>		<u>1st</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>	<u>95th</u>	<u>99th</u>
36	Head Length	16.3	16.8	17.0	17.4	17.8	18.3	18.7	18.9	19.4
37	Head Height	10.4	11.1	11.5	12.0	12.7	13.4	14.0	14.4	15.0
38	Face Length	9.9	10.4	10.6	11.0	11.4	11.8	12.2	12.4	12.8
39	Head Breadth	13.6	14.0	14.3	14.7	15.2	15.6	16.0	16.2	16.7
40	Head Circumference	50.8	51.8	52.3	53.1	54.0	55.0	55.8	56.4	57.3
41	Interpupillary Distance	5.4	5.7	5.9	6.1	6.4	6.7	7.0	7.1	7.5
42	Face Breadth	11.5	12.0	12.2	12.6	13.1	13.6	14.0	14.2	14.8
<u>HAND MEASUREMENTS</u>										
43	Hand Length	16.1	16.6	17.0	17.4	18.0	18.6	19.1	19.4	20.0
44	Palm Length	9.1	9.5	9.7	10.0	10.4	10.8	11.1	11.3	11.7
45	Hand Breadth	7.4	7.7	7.9	8.2	8.4	8.8	9.1	9.2	9.6
<u>FOOT MEASUREMENTS</u>										
46	Foot Length	22.0	22.8	23.2	23.8	24.6	25.4	26.0	26.4	27.2
47	Instep Length	15.6	16.3	16.6	17.2	17.8	18.5	19.1	19.4	20.1
48	Foot Breadth	8.5	8.9	9.1	9.5	9.8	10.3	10.7	11.0	11.6
49	Ball Foot Circumference	21.7	22.6	23.0	23.8	24.7	25.6	26.5	27.1	28.2
50	Heel Breadth	5.5	5.8	5.9	6.1	6.4	6.7	6.9	7.1	7.4
51	Heel-Ankle Circumference	28.8	29.8	30.3	31.1	32.1	33.1	34.0	34.7	35.8
52	Weight (Kilograms)	45.5	48.0	50.0	52.5	56.0	60.0	64.0	67.0	73.0

In using the percentile values, it may be pointed out that for a particular dimension, the measurement on 95 percent of the men in the series will be equal to or less than the value shown for the 95th percentile, while on the remaining five percent, the measurement will be greater than the 95th percentile value. In the case of stature, for example (Table 4.1), 95 percent of Thai military personnel will be 172 centimeters or less in height, while only five percent will be taller than 172 centimeters. Similarly, the measurement on five percent of the men in the series will be equal to or less than the value shown for the 5th percentile, while on the remaining 95 percent, the measurement will be greater than the 5th percentile value. Again, in the case of stature, five percent of Thai military personnel will be 155 centimeters or less in height, while 95 percent will be taller than 155 centimeters. In effect, then, the 1st and 99th percentile values of a measurement indicate the range of that measurement for the middle 98 percent of the population, while the 5th and 95th percentile values of a measurement define the range for the middle 90 percent of the population.

For ready reference by those not accustomed to the metric system, percentile values for all of the body measurements are given in inches in Tables 4.5, 4.6 and 4.7. Weight (52 in Table 4.7) is shown in pounds.

Table 4.5. Percentiles of Standing and Sitting Measurements
(values in inches)

STANDING MEASUREMENTS		PERCENTILES							
	1st	5th	10th	25th	50th	75th	90th	95th	99th
1 Stature	59.6	61.0	61.8	63.0	64.4	65.7	66.9	67.7	69.3
2 Shoulder Height	48.6	49.8	50.6	51.8	53.0	54.3	55.7	56.1	57.5
3 Waist Height	35.0	36.2	36.8	38.0	39.0	40.2	41.3	41.9	43.1
4 Crotch Height	26.2	27.2	27.8	28.7	29.7	30.7	31.7	32.3	33.3
5 Kneecap Height	17.1	17.9	18.3	18.9	19.7	20.3	20.9	21.5	22.0
6 Coat Length	21.7	22.8	23.4	24.4	25.6	26.8	27.6	28.3	29.5
7 Hip Breadth, Standing	10.4	10.8	11.0	11.4	11.8	12.2	12.6	12.8	13.2
SITTING MEASUREMENTS									
8 Sitting Height	31.3	32.1	32.5	33.3	34.1	34.8	35.6	36.0	36.8
9 Eye Height, Sitting	26.6	27.6	28.0	28.7	29.5	30.3	31.1	31.5	32.3
10 Shoulder Height, Sitting	20.1	20.9	21.3	21.8	22.4	23.2	24.0	24.4	25.2
11 Shoulder-Elbow Length	12.2	12.6	12.8	13.2	13.8	14.2	14.6	14.8	15.4
12 Forearm-Hand Length	16.1	16.7	16.9	17.5	18.1	18.5	19.1	19.3	19.9
13 Buttock-Knee Length	18.9	19.7	19.9	20.7	21.3	21.8	22.4	22.8	23.4
14 Buttock-Popliteal Length	15.4	15.9	16.3	16.9	17.5	18.1	18.7	19.1	19.9
15 Knee Height, Sitting	18.1	18.7	18.9	19.5	20.1	20.7	21.1	21.5	22.0
16 Popliteal Height	15.0	15.6	15.7	16.3	16.9	17.3	17.7	18.1	18.5
17 Shoulder Breadth	14.6	15.2	15.4	15.7	16.3	16.9	17.3	17.7	18.5
18 Hip Breadth, Sitting	10.6	11.2	11.4	12.0	12.4	13.0	13.6	14.0	14.8
19 Arm Reach, Upward	47.2	48.6	49.2	50.4	51.8	53.0	54.1	54.7	55.9
20 Arm Reach, Forward	28.3	29.5	30.1	31.1	32.3	33.3	34.3	34.8	35.8

Table 4.6. Percentiles of Circumferences and Surface Measurements
(values in inches)

PERCENTILES										
BODY CIRCUMFERENCES		1st	5th	10th	25th	50th	75th	90th	95th	99th
21	Neck Circumference	12.0	12.3	12.5	12.9	13.3	13.7	14.1	14.3	14.9
22	Shoulder Circumference	37.4	38.4	39.0	40.0	40.9	42.1	43.3	44.1	46.1
23	Chest Circumference	29.9	30.9	31.5	32.3	33.5	34.4	35.4	36.2	37.8
24	Waist Circumference	23.6	24.6	25.2	26.0	27.2	28.5	29.9	30.7	33.1
25	Hip Circumference	30.7	31.5	32.1	32.9	33.9	35.0	36.0	36.8	38.4
26	Upper Arm Circumference	8.5	9.1	9.3	9.6	10.2	10.8	11.2	11.6	12.4
27	Wrist Circumference	5.4	5.6	5.7	5.9	6.1	6.4	6.6	6.7	7.0
28	Crotch-Thigh Circum.	16.3	17.1	17.7	18.5	19.3	20.3	21.3	21.8	23.2
29	Lower Thigh Circumference	12.0	13.0	13.4	14.0	15.0	15.9	16.7	17.3	18.5
30	Calf Circumference	11.6	12.0	12.4	12.8	13.4	14.0	14.6	15.0	15.7
31	Ankle Circumference	7.2	7.5	7.7	8.0	8.2	8.5	8.8	9.0	9.4
SURFACE MEASUREMENTS										
32	Back-Waist Length	14.4	15.2	15.6	16.1	16.9	17.7	18.3	18.7	19.7
33	Interscye Breadth	11.6	12.4	12.6	13.2	13.8	14.6	15.2	15.6	16.3
34	Sleeve Inseam	15.9	16.7	17.1	17.7	18.5	19.1	19.9	20.3	20.9
35	Sleeve Length	27.4	28.3	28.9	29.7	30.7	31.7	32.7	33.1	34.1

Table 4.7. Percentiles of Head, Hand and Foot Measurements
(values in inches)

		<u>PERCENTILES</u>								
<u>HEAD MEASUREMENTS</u>		<u>1st</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>	<u>95th</u>	<u>99th</u>
36	Head Length	6.4	6.6	6.7	6.8	7.0	7.2	7.4	7.4	7.6
37	Head Height	4.1	4.4	4.5	4.7	5.0	5.3	5.5	5.7	5.9
38	Face Length	3.9	4.1	4.2	4.3	4.5	4.6	4.8	4.9	5.0
39	Head Breadth	5.4	5.5	5.6	5.8	6.0	6.1	6.3	6.4	6.6
40	Head Circumference	20.0	20.4	20.6	20.9	21.3	21.7	22.0	22.2	22.6
41	Interpupillary Distance	2.1	2.2	2.3	2.4	2.5	2.6	2.8	2.8	3.0
42	Face Breadth	4.5	4.7	4.8	5.0	5.2	5.4	5.5	5.6	5.8
<u>HAND MEASUREMENTS</u>										
43	Hand Length	6.3	6.5	6.7	6.8	7.1	7.3	7.5	7.6	7.9
44	Palm Length	3.6	3.7	3.8	3.9	4.1	4.2	4.4	4.5	4.6
45	Hand Breadth	2.9	3.0	3.1	3.2	3.3	3.5	3.6	3.6	3.8
<u>FOOT MEASUREMENTS</u>										
46	Foot Length	8.7	9.0	9.1	9.4	9.7	10.0	10.2	10.4	10.7
47	Instep Length	6.1	6.4	6.5	6.8	7.0	7.3	7.5	7.6	7.9
48	Foot Breadth	3.4	3.5	3.6	3.7	3.9	4.0	4.2	4.3	4.6
49	Ball Foot Circumference	8.5	8.9	9.1	9.4	9.7	10.1	10.4	10.7	11.1
50	Heel Breadth	2.2	2.3	2.3	2.4	2.5	2.6	2.7	2.8	2.9
51	Heel-Ankle Circumference	11.3	11.7	11.9	12.2	12.6	13.0	13.4	13.7	14.1
52	Weight (Pounds)	100	106	110	116	124	132	141	148	161

c. Means and Standard Deviations

While the anthropometric data for a population are useful in the form of percentiles, other statistical values also are of interest. There are two kinds of averages frequently employed for anthropometric data. These are the arithmetic mean and the median. The mean of a measurement is the average value of that measurement, obtained by dividing the sum of the values by the number of values. The median may be defined as the middle value in a series of data. Since the median corresponds to the 50th percentile value, medians are not shown separately here, but they may be found in the tables of percentiles.

The standard deviation (S.D.) is an indication of the variability of a measurement within the population. If most of the values for a measurement are close to the mean value, the standard deviation will be small, but if many of the values are much lower or higher than the mean, the standard deviation will be large. As a general estimate, the mean minus one standard deviation and plus one standard deviation will give a range which covers approximately the middle two-thirds of the values for any given measurement. Similarly a range determined by subtracting and adding two standard deviations from and to the mean will include approximately 95 percent of the values for a given measurement. Practically all of the values of a measurement will fall within a range determined by subtracting and adding three standard deviations from and to the mean value of that measurement.

Finally, the coefficient of variation (V) is a statistical value which expresses the standard deviation as a percentage of the mean.

Although the anthropometric survey of Thailand included samples of men drawn from the Royal Thai Army, the Royal Thai Marine Corps and the Royal Thai Air Force, the percentile values for the body measurements discussed above are based upon the total series of 2,950 Thai military personnel. However, additional statistical values have been computed for the total series, and for the Army, Marine Corps and Air Force samples separately. These statistical values, consisting of the mean, the standard deviation (S.D.) and the coefficient of variation (V) for each body measurement are presented in Tables 4.8, 4.9 and 4.10. The means and standard deviations are given in centimeters (with weight in kilograms), while the coefficients of variation are expressed as percentages.

Table 4.8. Statistical Values of Standing and Sitting Measurements
(values in centimeters)

STANDING MEASUREMENTS		ARMY		MARINE CORPS		AIR FORCE		TOTAL SERIES		
		Mean	S.D.	V(%)	Mean	S.D.	V(%)	Mean	S.D.	V(%)
1	Stature	162.9	5.3	3.2	163.9	5.1	3.1	165.4	5.1	3.1
2	Shoulder Height	134.3	4.7	3.5	134.5	4.8	3.6	133.8	5.0	3.7
3	Waist Height	98.5	4.3	4.4	99.9	4.0	4.0	100.5	4.6	4.6
4	Crotch Height	74.8	3.8	5.1	76.7	3.7	4.8	75.4	3.9	5.2
5	Kneecap Height	49.5	2.6	5.2	49.6	2.4	4.8	50.0	2.9	5.8
6	Coat Length	63.9	4.0	6.2	66.6	4.2	6.3	66.8	3.7	5.5
7	Hip Breadth, Standing	29.9	1.5	5.0	29.7	1.4	4.7	30.8	1.5	4.9
SITTING MEASUREMENTS										
8	Sitting Height	86.1	3.2	3.7	86.7	2.8	3.2	87.4	2.7	3.1
9	Eye Height, Sitting	74.5	3.3	4.4	74.7	2.8	3.7	75.8	2.6	3.4
10	Shoulder Height, Sitting	57.4	2.7	4.7	57.0	2.4	4.2	56.4	2.4	4.2
11	Shoulder-Elbow Length	34.8	1.7	4.9	35.0	1.7	4.8	35.1	1.9	5.4
12	Forearm-Hand Length	45.6	2.0	4.4	46.1	2.0	4.3	45.5	1.8	4.0
13	Buttock-Knee Length	53.5	2.5	4.7	54.7	2.3	4.2	54.3	2.4	4.4
14	Buttock-Popliteal Length	44.3	2.4	5.4	44.9	2.4	5.3	45.2	2.5	5.5
15	Knee Height, Sitting	50.7	2.1	4.1	51.2	2.0	3.9	51.1	2.6	5.1
16	Popliteal Height	42.2	1.8	4.3	42.9	1.6	3.7	43.7	1.8	4.1
17	Shoulder Breadth	41.3	2.0	4.8	42.5	1.9	4.5	41.7	1.9	4.6
18	Hip Breadth, Sitting	32.0	2.0	6.2	30.6	2.2	7.2	33.3	2.0	6.0
19	Arm Reach, Upward	131.0	4.8	3.7	132.4	4.6	3.5	130.4	4.5	3.4
20	Arm Reach, Forward	81.8	4.1	5.0	83.3	3.5	4.2	77.9	4.2	5.4
Number of Men		2,010		610		330		2,950		

Table 4.9. Statistical Values of Circumferences and Surface Measurements
(values in centimeters)

BODY CIRCUMFERENCES	ARMY		MARINE CORPS		AIR FORCE		TOTAL SERIES	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	V(%)
21 Neck Circumference	33.7	1.6	34.1	1.5	33.8	1.6	33.8	1.6
22 Shoulder Circumference	104.4	4.4	104.9	4.3	104.7	4.7	104.5	4.4
23 Chest Circumference	84.9	4.1	84.9	3.7	86.1	4.5	85.0	4.1
24 Waist Circumference	69.7	5.0	69.9	4.2	69.5	5.9	69.7	5.0
25 Hip Circumference	86.0	4.1	86.6	3.5	87.4	4.4	86.3	4.1
26 Upper Arm Circumference	25.8	2.1	26.6	1.9	26.4	2.2	26.0	2.1
27 Wrist Circumference	15.6	0.9	15.9	0.8	15.5	0.8	15.7	0.9
28 Crotch Thigh Circum.	49.3	3.7	49.6	3.1	50.8	4.2	49.5	3.7
29 Lower Thigh Circum.	37.6	3.6	39.7	3.0	38.5	3.7	38.1	3.6
30 Calf Circumference	34.0	2.3	35.0	2.1	34.1	2.3	34.2	2.3
31 Ankle Circumference	20.8	1.1	21.3	1.1	21.3	1.2	21.0	1.2
SURFACE MEASUREMENTS								
32 Back Waist Length	42.9	2.5	42.7	3.0	45.6	2.6	43.2	2.8
33 Interscye Breadth	35.2	2.5	35.3	2.6	36.2	2.4	35.3	2.6
34 Sleeve Inseam	46.6	2.7	47.1	2.4	47.5	2.6	46.8	2.7
35 Sleeve Length	78.0	3.6	78.3	3.6	78.6	3.6	78.1	3.6
Number of Men	2,010		610		330		2,950	

Table 4.10. Statistical Values of Head, Hand and Foot Measurements
(values in centimeters)

HEAD MEASUREMENTS	ARMY			MARINE CORPS			AIR FORCE			TOTAL SERIES		
	Mean	S.D.	V(%)	Mean	S.D.	V(%)	Mean	S.D.	V(%)	Mean	S.D.	V(%)
36 Head Length	17.9	0.6	3.4	17.8	0.6	3.4	17.9	0.6	3.4	17.9	0.6	3.4
37 Head Height	13.0	0.9	6.9	12.4	0.8	6.5	12.3	1.1	8.9	12.8	1.0	7.8
38 Face Length	11.3	0.6	5.3	11.3	0.6	5.3	11.7	0.6	5.1	11.4	0.6	5.3
39 Head Breadth	15.2	0.7	4.6	15.1	0.6	4.0	15.4	0.5	3.2	15.2	0.7	4.6
40 Head Circumference	54.0	1.4	2.6	53.9	1.4	2.6	54.3	1.4	2.6	54.0	1.4	2.6
41 Interpupillary Distance	6.3	0.4	6.3	6.7	0.4	6.0	6.4	0.3	4.7	6.4	0.4	6.2
42 Face Breadth	13.2	0.7	5.3	12.8	0.6	4.7	13.4	0.7	5.2	13.1	0.7	5.3
HAND MEASUREMENTS												
43 Hand Length	18.0	0.8	4.4	18.0	0.8	4.4	18.1	0.8	4.4	18.0	0.8	4.4
44 Palm Length	10.3	0.5	4.9	10.5	0.5	4.8	10.5	0.5	4.8	10.4	0.5	4.8
45 Hand Breadth	8.5	0.4	4.7	8.5	0.5	5.9	8.5	0.5	5.9	8.5	0.4	4.7
FOOT MEASUREMENTS												
46 Foot Length	24.6	1.1	4.5	24.8	1.0	4.0	24.6	1.0	4.1	24.6	1.1	4.5
47 Instep Length	17.9	1.0	5.6	18.2	0.9	4.9	17.8	0.9	5.0	17.9	1.0	5.6
48 Foot Breadth	10.0	0.6	6.0	10.0	0.7	7.0	9.6	0.5	5.2	10.0	0.6	6.0
49 Ball Foot Circumference	24.8	1.4	5.6	25.2	1.3	5.2	24.2	1.2	5.0	24.8	1.4	5.6
50 Heel Breadth	6.4	0.4	6.2	6.6	0.4	6.1	6.4	0.4	6.2	6.5	0.4	6.2
51 Heel-Ankle Circumference	32.0	1.5	4.7	32.6	1.6	4.9	32.4	1.5	4.6	32.2	1.5	4.7
52 Weight (Kilograms)	56.3	5.8	10.3	55.6	5.4	9.7	57.6	6.2	10.8	56.3	5.8	10.3
Number of Men	2,010			610			330			2,950		

5. DISCUSSION OF THE DATA

a. Royal Thai Armed Forces

Since the survey included samples from the Army, Marine Corps and Air Force, data for these groups have been analyzed separately. A summary of the statistical values for the Royal Thai Armed Forces is given in Table 5.1.

The samples from the three services differ somewhat in mean age. The Marine Corps sample has the lowest mean age, the large Army sample is intermediate in age, while the Air Force sample shows the highest mean age. Average weights for the three services reflect the differences in mean age. The Marines are lightest, the Army sample is intermediate, while the Air Force group has the highest mean weight. With respect to stature, Army personnel show the lowest average (162.9 cm); the Marines are one centimeter taller (163.9 cm), while the Air Force sample (165.4 cm) averages 1.5 centimeters taller than the Marines. Army and Marine Corps personnel have the same average chest girth (84.9 cm), but the Air Force sample is somewhat larger in this measurement (86.1 cm). While it may be demonstrated that these differences are significant on the basis of statistical analysis, the differences in body size among the Armed Forces are not considered to be of practical significance.

Table 5.1. Statistical Values for Royal Thai Armed Forces

	<u>ARMY</u>			<u>MARINE CORPS</u>			<u>AIR FORCE</u>		
	Mean	S.D.	V(%)	Mean	S.D.	V(%)	Mean	S.D.	V(%)
Age (years)	24.2	4.2	17.4	22.0	1.8	8.2	26.8	4.4	16.4
Weight (kg)	56.3	5.8	10.3	55.6	5.4	9.7	57.6	6.2	10.8
Stature(cm)	162.9	5.3	3.2	163.9	5.1	3.1	165.4	5.1	3.1
Chest Cir(cm)	84.9	4.1	4.8	84.9	3.7	4.4	86.1	4.5	5.2
Number of Men	2,010			610			330		

b. Geographical Differences

Of the large Royal Thai Army sample (2,010 men) in the survey, 1,187 men (59 percent) were measured in the Bangkok area, while 823 men (41 percent) were measured at three RTA installations at Haad Yai, Ubol and Chiangmai. The analysis of birthplace has shown that in general men are stationed in the area in which they were born. The Army personnel measured in Bangkok, therefore, are predominantly men from the central part of Thailand, while those measured at Haad Yai, Ubol and Chiangmai are largely from the south, east and north, respectively.

The statistical values for body size of Army men measured in Bangkok, as contrasted with Army men measured at the other three locations, are given in Table 5.2. The Bangkok Army personnel are, on the average, heavier by .6 kilograms and taller by 2.8 centimeters, but they are also smaller in chest girth by 1.2 centimeters. The Army personnel measured in Bangkok are, however, about three and one half years older in mean age, which may be explained by the fact that a large number of the troops measured at the other three Army installations were 21 and 22-year-old recruits.

Table 5.2. Statistical Values for Royal Thai Army

	<u>ARMY - Bangkok</u>			<u>ARMY - Other Locations</u>		
	Mean	S.D.	V(%)	Mean	S.D.	V(%)
Age (yrs)	25.7	4.8	18.7	22.1	1.0	4.5
Weight (kg)	56.5	6.4	11.3	55.9	4.9	8.8
Stature (cm)	164.0	5.2	3.2	161.2	4.9	3.0
Chest Circum (cm)	84.4	4.4	5.2	85.6	3.4	4.0
Number of Men	1,187			823		

c. Age Changes in Weight and Stature

When the data of an anthropometric survey are sufficient to warrant such analysis, it is of interest to examine the changes in weight and height in a population with increasing age. Means and standard deviations for the weight and stature of Thai military personnel have been calculated for age groups between 18 and 35 years, as shown in Table 5.3. The data indicate a gradual increase in both weight and height with increasing age. Mean weight in this series begins with a value of 52 kilograms at age 18, and rises sharply to 56 kilograms in the 20-22 year age group. Mean weight for 27-year-olds is about 58 kilograms, while the highest weight in this series is about 60 kilograms at age 34. The lowest mean stature in this series is 162.4 centimeters at age 21. Stature increases to 166.0 centimeters for 27-year-olds, with a maximum of 166.6 at age 32.

Table 5.3. Mean Weight and Height of Thai Military Personnel by Age

<u>Age (yrs.)</u>	<u>Number</u>	<u>Weight (kg)</u>			<u>Stature (cm)</u>		
		<u>Mean</u>	<u>S.D.</u>	<u>V(%)</u>	<u>Mean</u>	<u>S.D.</u>	<u>V(%)</u>
18	31	51.8	4.2	8.1	162.7	4.8	3.0
19	63	54.0	5.1	9.4	163.8	5.4	3.3
20	58	56.1	4.3	7.7	164.5	4.4	2.7
21	867	56.1	5.2	9.3	162.4	5.2	3.2
22	982	56.1	5.4	9.6	163.0	5.4	3.3
23	171	55.5	4.7	8.5	163.6	5.3	3.2
24	61	56.8	6.0	10.6	164.7	4.4	2.7
25	68	57.0	7.1	12.5	165.3	5.1	3.1
26	60	56.5	5.6	9.9	165.2	5.3	3.2
27	62	58.1	6.8	11.7	166.0	4.7	2.8
28	86	56.6	6.3	11.1	165.0	4.4	2.7
29	70	56.3	6.1	10.8	164.3	5.0	3.0
30	121	56.5	6.6	11.7	163.6	5.7	3.5
31	82	55.6	7.0	12.6	164.5	5.6	3.4
32	52	58.8	8.0	13.6	166.6	4.7	2.8
33	30	59.3	8.4	14.2	164.7	4.6	2.8
34	24	59.8	7.2	12.0	164.7	4.1	2.5
35	18	58.0	5.3	9.1	166.3	4.4	2.6

d. Nutrition Survey of Thailand

In any anthropometric survey, questions relating to the representation of the samples of men measured or to the reliability of the data may be raised. In the case of Thailand, it is fortunate that comparable data on height and weight are available. These data corroborate the results of the anthropometric survey.

Between October and December 1960, a nutrition survey was conducted in Thailand by a joint Thai-American team under the sponsorship of the Interdepartmental Committee on Nutrition for National Defense of the United States Department of Defense. The report on this survey was published in February, 1962. During the survey, clinical and nutritional studies were made on 4,325 Royal Thai Army, Navy (Marine Corps), and Air Force personnel at eleven military installations in Thailand. Several of the units sampled in the nutritional survey of 1960 were the same as those sampled in the anthropometric survey of 1962. The Royal Thai Army units were the 11th Infantry Regiment (Bangkok), the 5th Regimental Combat Team (Songhkla), the 6th RCT (Ubol), the 7th RCT (Chiangmai), while Royal Thai Marine Corps personnel at Sattahip also were sampled in both surveys.

A summary of the pertinent data from the anthropometric and nutrition surveys of Thailand is given in Table 5.4. In the total series (combined services), Thai personnel measured in the anthropometric survey averaged two years older, .9 kilograms heavier and .4 centimeters taller than men measured during the nutrition survey. In general, the means of age, weight and height for the different services are comparable in the two surveys. While the data obtained in the two surveys show some minor differences, these are not considered to be of practical significance.

Table 5.4. Anthropometric and Nutrition Surveys of Thailand:
Means of Age, Weight and Stature

<u>Sample</u>	<u>Number</u>	<u>Age (yrs.)</u>	<u>Weight (kg)</u>	<u>Stature (cm)</u>
Anthropometric Survey (1962):				
Army	2,010	24.2	56.3	162.9
Marine Corps	610	22.0	55.6	163.9
Air Force	330	26.8	57.6	165.4
Total Series	2,950	24.0	56.3	163.4
Nutrition Survey (1960):				
Army	2,917	22	55.2	163
Marine Corps	624	22	57.4	163
Air Force	784	24	55.0	164
Total Series	4,325	22	55.4	163

e. Related Anthropometry of Other Countries

Since data on the height and weight of Thai military personnel are now available from both anthropometric and nutrition surveys, it is of some interest to compare these values with similar data for samples of military personnel of other Asian countries. Means of weight and stature for various Asian countries are given in Table 5.5, together with the mean ages of the samples measured. An anthropometric survey of military personnel of the Republic of Vietnam was conducted in 1963, (under the sponsorship of ARPA) while a nutrition survey was carried out there in 1959. Nutrition surveys also were conducted between 1956 and 1961 in Pakistan, Burma, The Philippines, the Republic of China (Taiwan) and the Republic of Korea, all under the sponsorship of the United States Interdepartmental Committee on Nutrition for National Defense. The data shown in Table 5.5 have been abstracted from the reports of these nutrition surveys.

**Table 5.5. Means of Age, Weight and Stature
for Various Asian Countries**

<u>Country</u>	<u>Date</u>	<u>Number</u>	<u>Age</u> (yrs)	<u>Weight</u> (kg)	<u>Stature</u> (cm)
Thailand:					
Anthropometric Survey	1962	2,950	24.0	56.3	163.4
Nutrition Survey	1960	4,325	22	55.4	163
Republic of Vietnam:					
Anthropometric Survey	1963	2,129	26.8	51.1	160.5
Nutrition Survey	1959	2,820	25.5	51.4	159.5
Nutrition Surveys:					
Union of Burma	1961	4,956	26.5	52.9	163.0
Philippines	1957	4,234	30	55.5	162.6
Republic of China	1960	3,894	28.5	55.4	164.3
Republic of Korea	1956	1,514	25	58.9	164.1
Pakistan	1956	2,019	25.6	58.6	170.0

The data in Table 5.5 indicate that Thai military personnel are approximately four kilograms heavier and three centimeters taller on the average than Vietnamese military personnel, although the Thai series have lower mean ages. Thai military personnel also are slightly heavier (three kilograms) but of about the same height on the average as Burmese military personnel. While the military sample from the Philippines is older, with an average age of 30 years, the Filipinos show about the same weight and height as the Thais. The Thais appear to be slightly shorter than Chinese and Korean military personnel; they are also of about the same mean weight as the Taiwan Chinese, but a few kilograms lighter in weight than Koreans. Thai military personnel are approximately 2.5 kilograms lighter than Pakistani military personnel, and almost seven centimeters shorter in stature.

An approximation of body build may be made through the use of an index expressed by dividing stature by the cubic root of weight. On this basis, the data on height and weight shown in Table 5.5 indicate that, in general, Pakistanis, Burmese, Chinese and Vietnamese appear to be relatively slender for their height, while Filipinos, Thais and Koreans are relatively heavier for their height.

6. HUMAN FACTORS IMPLICATIONS OF THE DATA

a. Human Engineering

The anthropometric data presented in this report should receive wide use and application in the human engineering of equipment for Thai military personnel. The utilization of information on the body size of Thai military personnel will serve as an important factor in improving the efficiency and performance of Thai man-equipment systems.

Detailed sizing and space requirements for military equipment intended for use by the Royal Thai Armed Forces may be developed from the body size data of this report. The specific information required will vary with the design problem under consideration, but most of the basic requirements with respect to body size are included within the 52 body dimensions taken during this survey.

Many human engineering problems in design, sizing and adjustability involve the spatial requirements of the seated operator. Data on sitting height, eye height, shoulder height and knee height, as well as shoulder and hip breadths are required for the seated operator. Also of importance in this category are the arm reach measurements.

In considering the use of American equipment by the Royal Thai Armed Forces, some of the differences in body size between Thai and U. S. military personnel may be noted. The average weight of Thai military personnel is 56 kilograms (124 pounds), while U. S. Army men average 70.4 kilograms (155 pounds). The difference of about 30 pounds in average body weight is of considerable importance with respect to the weight to be carried by the individual soldier. If it is assumed that the soldier's load should not exceed one-third of his body weight, it is apparent that the American soldier could carry about 23 kilograms or 50 pounds on the average, whereas the Thai soldier should be limited to about 18 kilograms or 40 pounds.

The average height of Thai military personnel is 163.4 centimeters (64.3 inches); this value is equivalent to the 5th percentile of U. S. Army stature. In other words, only five percent of U. S. Army men are shorter than the average Thai, while 95 percent are taller. The average height of U. S. Army men is 174.0 centimeters (68.5 inches); thus, the American soldier is about 10.6 centimeters (4.2 inches) taller on the average than the Thai serviceman.

The difference in stature between American and Thai military personnel is also reflected in the differences in other body proportions. The Thai soldier has a shorter torso and shorter arms and legs than the American. These differences become important in human engineering considerations, since it is obvious that in operating American equipment, the Thai cannot reach as far with his hands or his feet as the American.

Body girth and body breadth measurements are smaller for Thai military personnel. Items of personal equipment intended for use by Thais, such as load-carrying suspenders and belts or parachute harnesses must be capable of adjustment to accommodate these smaller girths.

b. Clothing

Since no information is available as yet on the size systems for military clothing currently in use by the Armed Forces of Thailand, no attempt is made here to assess the adequacy of such size systems with respect to the anthropometric data now available. However, some general comments may be made on the ranges of available Thai body measurements in terms of clothing sizes.

The overall range of stature among Thai military personnel is some 33 centimeters. If clothing is sized in three lengths, each length would be required to fit men with a range of 11 centimeters in height. With four lengths of clothing, the range of stature for each length would be reduced to about 8.25 centimeters. Two additional body measurements are of use in considering the lengths of upper body clothing. One of these is coat length, which is the vertical distance from the base of the neck to the base of the thumb. Since the overall range of this measurement among Thai military personnel is 26 centimeters, each of three lengths would be required to fit a range of about 8.7 centimeters in coat length. A second body length measurement is back-waist length, measured from the base of the neck to the waist level. The range of this measurement is 17.5 centimeters; thus, each of three lengths would be required to fit a range of about 5.8 centimeters in back-waist length.

The overall range of chest circumference among Thai military personnel is 27 centimeters. Thus, with three girth sizes of upper body clothing, each size would be required to fit a range of nine centimeters. Neck circumference and sleeve lengths are utilized in the sizing of shirts. The range of neck circumference in this series is 10.4 centimeters, while the range of sleeve length is 23 centimeters.

Waist circumference and crotch height (or inseam) are the two body measurements controlling the sizing of trousers. The overall range of waist circumference among Thai military personnel is 34 centimeters. With three waist sizes of trousers, each size would be required to fit a range of 11.3 centimeters in waist girth. With four sizes, the waist girth range for each size would be reduced to 8.5 centimeters. The range of the crotch height or inseam measurement is 24 centimeters. Therefore, each of three trouser inseam lengths would be required to fit a range of eight centimeters in inseam.

The range of head circumference may be used for the sizing of headwear. Head circumference among Thai military personnel covers a range of 6.5 centimeters.

The overall range of foot length among Thai military personnel is about seven centimeters, while the range of foot breadth is 3.25 centimeters. In general, the Thai foot appears to be relatively short and broad. The hands of the Thai soldier also are relatively short and broad.

In conclusion, it is obvious that only a few of the human factors implications of the anthropometric survey of Thailand have been suggested. The application of the information on body sizes of Thai military personnel will involve a research effort covering several years. A start has been made, however, and data on the range and variation in body size in the military population of Thailand are now available for use.

7. SUMMARY

During an anthropometric survey of military personnel of Thailand, 52 body measurements were made on 2,950 members of the Royal Thai Armed Forces. The series included samples of men from the Army, Marine Corps and Air Force. The resulting anthropometric data have been analyzed and are available for application in size systems for clothing and personal equipment and in the human engineering of man-operated equipment for the military population of Thailand.

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APPENDIX A

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Number

แบบฟอร์มการสำรวจข้อมูลการวัดตัว
ANTHROPOMETRIC SURVEY DATA SHEET

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APPENDIX B

Instructions for Anthropometric Measurements

STATION #1

Preliminary: Fill in background information on front of data sheet according to instructions.

1. Weight. Weigh man and record his weight to nearest kilogram.

STATION #2

Measurements 2 through 12 will be made with an anthropometer.
Total of 11 measurements.

A - Man standing on the floor:

2. Height. With the man standing erect, measure from the floor to the top of his head.
3. Shoulder height. With the man standing erect, measure from the floor to the outer point of his right shoulder.
4. Waist height. Measure from the floor to the top of his right hip bone (the level at the waist where the trousers normally are worn).
5. Crotch height. Measure from the floor to the crotch.
6. Kneecap height. Measure from the floor to the top of the right kneecap.

B - Man sitting on a table or bench with his feet on a box so that his knees are at right angles:

7. Arm reach upward. With the man sitting and with his right arm extended above his shoulder, measure from the seat to the tip of the middle finger in his extended hand.
8. Sitting height. With the man sitting erect, measure from the seat to the top of his head.
9. Eye height, sitting. With the man sitting, measure from the seat to the level of his right eye (at the inner corner of the eye).

10. Shoulder height, sitting. With the man sitting, measure from the seat to the outer point of his right shoulder.

11. Knee height, sitting. With the man sitting and with his knees at right angles (foot rest should be adjusted), measure from the foot rest to the top of his right knee.

12. Popliteal height. With the man sitting and with his knees at right angles (foot rest should be adjusted), measure from the foot rest to the underside of the right knee.

STATION #3

Measurements 13 through 22 will be made with a large sliding caliper (top two sections of anthropometer). Total of 10 measurements.

A - Man standing on the floor:

13. Coat length. With the man standing, measure from the level of the base of back of neck to the first knuckle of the right thumb.

14. Hip breadth, standing. With the man standing, measure the maximum breadth across the hips.

B - Man sitting on a table or bench:

15. Arm reach forward. With the man sitting and with his right arm extended horizontally in front of him, measure from the back of the shoulder to the tip of the middle finger in his extended hand.

16. Buttock-knee length. With the man sitting and with his knees at right angles, measure from the back of his hip to the front of his right knee.

17. Buttock-popliteal length. With the man sitting and with his knees at right angles, measure from the back of his hip to the back of his right knee.

18. Shoulder breadth. With the man sitting, measure the maximum breadth across the shoulders, including both arms.

19. Hip breadth, sitting. With the man sitting, measure the maximum breadth across the hips.

20. Head height. With the man sitting, measure from the notch at the front of the right ear to the top of the head.

21. Shoulder-elbow length. With the man sitting and with his right arm held so that it forms a right angle at the elbow, measure from the point of the shoulder to the elbow.

22. Forearm-hand length. With the man sitting and with his right arm held so that it forms a right angle at the elbow, measure from the elbow to the tip of the middle finger in his extended hand.

STATION #4

Measurements 23 through 25 will be made with a foot box; measurements 26 through 31 will be made with small sliding calipers; and measurements 32 through 34 will be made with small spreading calipers. Total of 12 measurements.

A - Man standing on the floor with his right foot in the foot box, and his weight distributed on both feet:

23. Foot length. Measure the maximum length of the right foot, from the heel to the tip of the longest toe.

24. Instep length. Measure the length of the instep from the heel to the inner ball of the foot.

25. Foot breadth. Measure the maximum breadth of the right foot.

B - Remove foot box; man remains standing:

26. Heel breadth. Measure the maximum breadth of the right heel behind and below the projections of the ankle bones.

C - Man sitting on a chair:

27. Hand length. With the man's right hand extended, and with the palm up and the fingers straight, measure the length of the hand from the wrist to the tip of the middle finger.

28. Palm length. With the man's right hand extended, and with the palm up and the fingers straight, measure from the wrist to the base of the middle finger.

29. Hand breadth. With the man's right hand extended and with the palm up, measure the maximum breadth across the base of the fingers.

30. Face length. Measure the length of the face from the root of the nose (depression between the eyes) to the tip of the chin.

31. Interpupillary distance. Measure the distance between the centers (pupils) of the eyes.

32. Face breadth. Measure the maximum breadth of the face between the cheek bones.

33. Head breadth. Measure the maximum breadth of the head (usually found above and behind the ears).

34. Head length. Measure the maximum length of the head, from the forehead (slightly above the eyes) to the back of the head.

STATION #5

Measurements 35 through 52 will be made with a steel tape. Total of 18 measurements.

A - Man standing on the floor:

35. Head circumference. Measure the maximum circumference of the head, with the tape passing over the forehead and just above both ears.

36. Neck circumference. Measure the circumference of the neck, with the tape passing just below the thyroid cartilage or "Adam's apple".

37. Shoulder circumference. Measure the maximum circumference of the shoulders, with the tape passing over the bulge of the deltoid muscles in both upper arms.

38. Chest circumference. With the man's arms raised, place the tape in position around the chest; then with the arms lowered, measure the circumference of the chest at the level of the nipples, during normal breathing.

39. Waist circumference. Measure the circumference of the waist at the level of the umbilicus, with the abdomen relaxed.

40. Hip circumference. Measure the maximum circumference of the hips at the level of the greatest protrusion of the buttocks.

41. Upper arm circumference. Measure the circumference of the right upper arm at the level of the biceps muscle, midway between the shoulder and the elbow (arm is relaxed, not flexed).

42. Wrist circumference. Measure the minimum circumference of the right wrist.

43. Sleeve inseam. With the right arm extended and held away from the body, measure from the front edge of the armpit along the arm to the wrist.

44. Interscye breadth. Measure the distance across the back between the creases of the armpits.

45. Back waist length. Measure the distance along the back from the base of the neck to the level of the waist.

46. Sleeve length. With the man's arms held horizontally and his fists pressed together, measure from the middle of the back, over the right elbow to the wrist, with the tape held horizontally.

B - Man standing on a box or bench:

47. Crotch-thigh circumference. Measure the circumference of the right upper thigh, with the tape passing below the gluteal furrow.

48. Lower thigh circumference. Measure the circumference of the right lower thigh with the tape passing just above the kneecap.

49. Calf circumference. Measure the maximum circumference of the right calf.

50. Ankle circumference. Measure the minimum circumference of the right ankle, with the tape passing just above the projections of the ankle bones.

51. Heel-ankle diagonal. Measure the diagonal circumference around the right ankle, with the tape passing under the heel and over the instep at the junction of the foot and the leg.

52. Ball foot circumference. With the front part of the man's right foot slightly raised, place the tape under the foot; then measure the maximum circumference of the foot at its widest point. The man should be standing with the feet slightly apart and with his weight distributed on both feet.

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<p>U. S. Army Natick Laboratories, Natick, Mass. ANTHROPOMETRIC SURVEY OF THE ROYAL THAI ARMED FORCES by Robert M. White, sponsored by Advanced Research Projects Agency, June 1964, 62 pp., illus.</p> <p>An anthropometric survey of the military personnel of Thailand was conducted between October 1962 and March 1963. Body measurements were obtained on a series of 2950 men of the Royal Thai Army, Marine Corps and Air Force. Fifty-two measurements were made on each individual. The anthropometric data have been analyzed and are presented in the form of statistical values. The results of the survey, which provide information on the body size of Thai military personnel, may be utilized in the engineering design and sizing of clothing, personal equipment, and man-operated equipment intended for use by the Royal Thai Armed Forces.</p>	<p>1. Thailand</p> <p>2. Anthropometry</p> <p>3. Clothing</p> <p>4. Military personnel</p> <p>5. Body</p> <p>6. Measurement</p> <p>7. Man</p> <p>8. Armed Forces supplies</p> <p>I. White, Robert M.</p> <p>II. Title</p> <p>III. Advanced Research Projects Agency</p>	<p>U. S. Army Natick Laboratories, Natick, Mass. ANTHROPOMETRIC SURVEY OF THE ROYAL THAI ARMED FORCES by Robert M. White, sponsored by Advanced Research Projects Agency, June 1964, 62 pp., illus.</p> <p>An anthropometric survey of the military personnel of Thailand was conducted between October 1962 and March 1963. Body measurements were obtained on a series of 2950 men of the Royal Thai Army, Marine Corps and Air Force. Fifty-two measurements were made on each individual. The anthropometric data have been analyzed and are presented in the form of statistical values. The results of the survey, which provide information on the body size of Thai military personnel, may be utilized in the engineering design and sizing of clothing, personal equipment, and man-operated equipment intended for use by the Royal Thai Armed Forces.</p>	<p>1. Thailand</p> <p>2. Anthropometry</p> <p>3. Clothing</p> <p>4. Military personnel</p> <p>5. Body</p> <p>6. Measurement</p> <p>7. Man</p> <p>8. Armed Forces supplies</p> <p>I. White, Robert M.</p> <p>II. Title</p> <p>III. Advanced Research Projects Agency</p>
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